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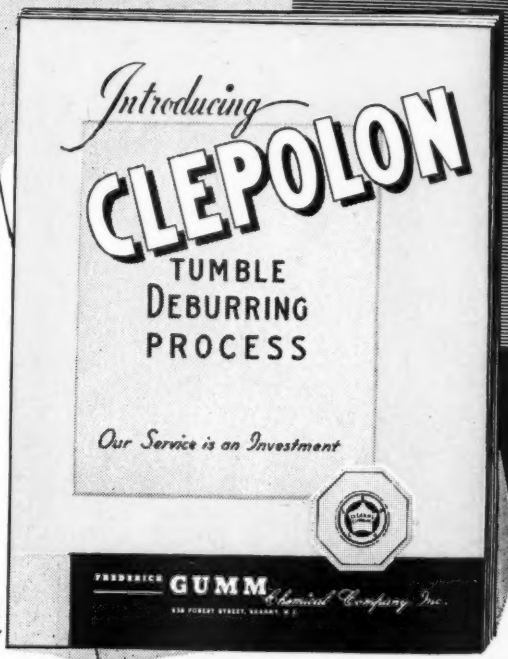
THE MONTHLY

Review

NOVEMBER ✦ ✦ ✦ 1946

Reliability
depends on
PROVEN PERFORMANCE



This new Clepolon Booklet includes complete operating instructions for Barrel Deburring and Barrel Lustre Finishing of Steel, Copper, Brass, Aluminum and Zinc Base Die-Cast metal parts prior to Electroplating.

Operating proceedure is included for removing moulding fins from rubber moulded parts also removing burrs from Die-cut plastics and excluded plastics cut-offs.

A request from you on your Company letterhead will bring this booklet to you immediately.

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.

firm-adhering electroplates

To save time in cleaning and substantially reduce rejects, tarnish brass or other copper-alloy work by means of the OAKITE OXBRITE PROCESS. This unique reverse-current cleaning process deliberately produces a controlled tarnish on buffed surfaces, then uniformly acid-strips the oxidation.

OAKITE OXBRITE PROCESS

IMPROVES adherence of bright nickel, chrome, cadmium or other plating finishes

THROWS OFF any metallic or soap films that may be deposited by direct-current cleaning

PRESERVES the lustre of highly finished surfaces

PERMITS direct bright-nickel plating of soft soldered brass pieces without first copper plating.

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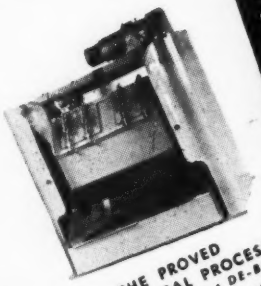
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**

MATERIALS · METHODS · SERVICE

Roto-Finish Equipment

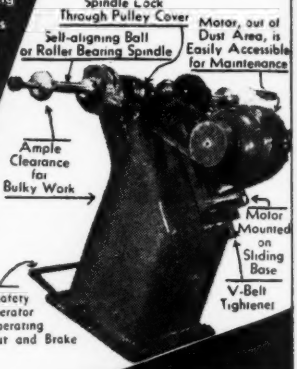


THE PROVED MECHANICAL PROCESS— FOR GRINDING · DE-BURRING POLISHING · HONING COLORING

ROTO-FINISH

An economical method of deburring on many production jobs. Maintains very close tolerances. If you have work which needs deburring, send us samples of both finished and unfinished parts with details of requirements. We will finish them — returning them to you with full data and our recommendations.

Stevens Safety Lathe


Spindle Lock Through Pulley Cover
Self-aligning Ball or Roller Bearing Spindle
Motor, out of Dust Area, is Easily Accessible for Maintenance
Ample Clearance for Bulky Work
Motor Mounted on Sliding Base
V-Belt Tightener
For Safety to Operator Foot Operating Motor Cut-out and Brake

GREEN SELECTRO-PLATER (Rectifier)

Wide range of capacities—25 to 5000 amperes all in one cabinet. Most capacities can be furnished in several types:—Standard (with meters and controls); Basic (without meters and controls); Remote Control (with separate remote controls and meters). Other variations may be engineered to adapt Selectro-Platers to special requirements.

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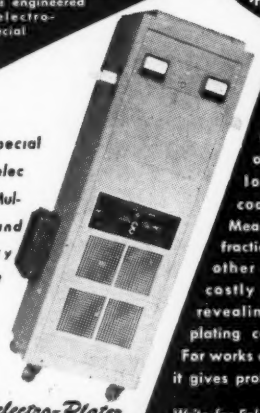
EVERYTHING FOR PLATING AND POLISHING

STEVENS SAFETY LATHE

When the operator's hands are busy the Lathe may be instantly stopped by slight pressure on the foot brake. Gives latest developments in operator's protection. Eliminates many injuries, with resultant loss of production time. *Write for booklet on this, and other Mitchell Buffing and Polishing Lathes.*

Write for special folder on Selectro-Platers, Multiplaters, and the Heavy Current Group.

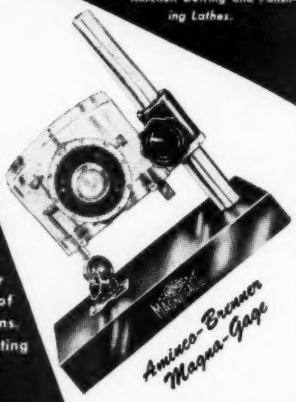


Green Selectro-Plater

MAGNA-GAGE

A rapid, non-destructive method of measuring local thickness of coatings on metals. Measurements made in a fraction of time required by other methods. Eliminates costly rejections by quickly revealing whether thickness of plating conforms to specifications. For works control or acceptance testing it gives profitable, positive results.

Write for Folder 2125.



Amineo-Brenner Magna-Gage

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BUFFING COMPOSITIONS · METAL POLISHERS AND ELECTROPLATERS SUPPLIES-EQUIPMENT

THE MONTHLY

Review

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Entered as second class matter July 1, 1946, at the post office at Philadelphia, Pa., under Act of August 24, 1912.

For efficient, economical bright zinc plating

1. DU PONT "ZIN-O-LYTE" Zinc Plating

► the only process yielding brilliant, blue-white zinc deposits direct from the bath *without bright*

2. DU PONT "DUROBRITE" Zinc Plating

► easily produces bright, lustrous deposits of pure zinc on steel surfaces of almost any size or

DU PONT "ZIN-O-LYTE" Zinc Plating

- the only process yielding brilliant, blue-white zinc deposits direct from the bath *without bright dipping!*
- high operating efficiency at both high and low current densities.
- baths easily made up from prepared salts.
- suitable for all types of zinc plating, particularly barrel plating.
- satisfactory for use with almost all types of ferrous metals.

DU PONT "DUROBRITE" Zinc Plating

- easily produces bright, lustrous deposits of pure zinc on steel surfaces of almost any size or shape!
- low in cost.
- bath made up easily with standard chemicals.
- easy to operate and control—gives good results under a wide range of operating conditions.
- rapid rate of deposition with high allowable current density.

Ask your Du Pont technical representative to give you complete details on how these Du Pont Zinc Plating Processes can save you time, trouble and cost! Or write to the Electroplating Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

Listen to "CAVALCADE OF AMERICA" every Monday evening over coast-to-coast NBC network.

DU PONT CHEMICALS • PROCESSES • SERVICE

for ELECTROPLATING

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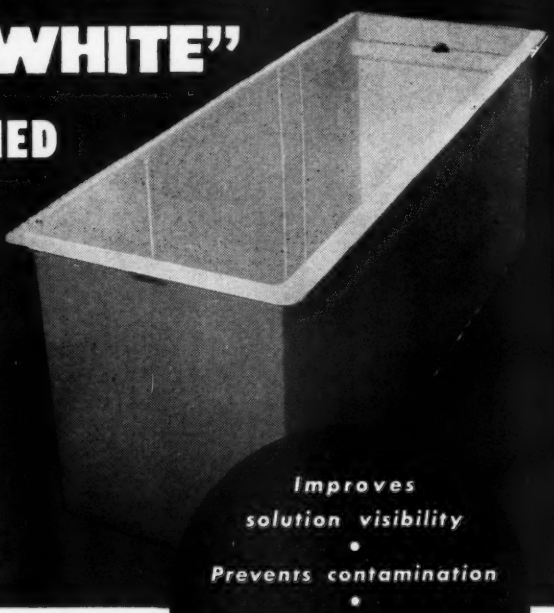
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

This new "WHITE" TYGON-LINED TANK



Improves solution visibility
•
Prevents contamination
•
Cuts electrical losses
•
Stops treeing-up on tank walls

There's as much difference between using a "white" Tygon-lined tank and an ordinary tank, in silver-plating, as there is between working in daylight and dark. With a "white" Tygon-lined tank you have real solution visibility, and clear-seeing to the bottom of the tank. You can tell quickly when to filter; you can see any parts that may have dropped to the bottom, which if overlooked could cause contamination.

With Tygon-lined tanks you can be sure of freedom from sulphur contamination; you can be sure of cutting current losses to a minimum; you can be sure of stopping silver treeing-up on tank walls.

Tygon, the chemically inert plastic, is applied in sheets $\frac{3}{32}$" thick, by our own special process, to tanks of any size or shape, either at our plant or in the field.

Tygon tank linings will resist any plating solution, have excellent electrical insulating properties, high abrasion resistance, operate perfectly at temperatures up to 175° F., and show no chemical deterioration with age.

● *Tygon is your best bet for your next plating tank*

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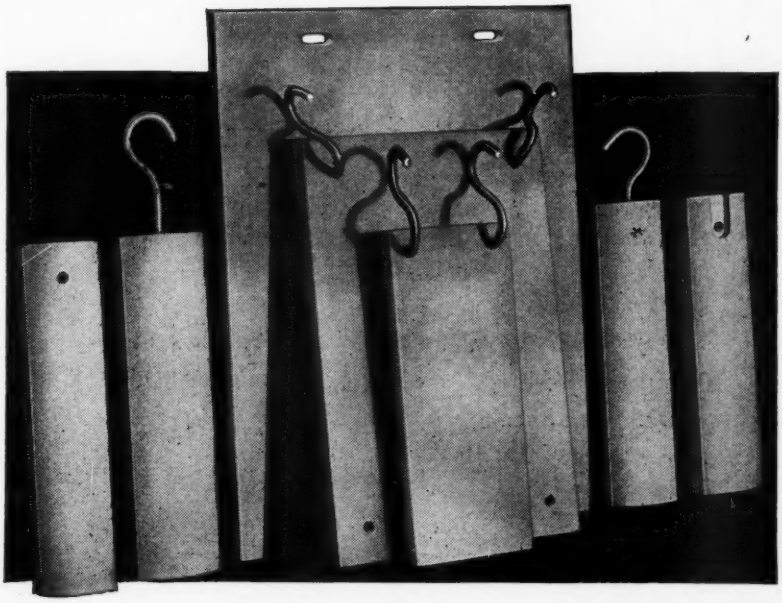
Since 1865 • Akron, Ohio



Enjoy all these advantages with *Anaconda Copper Anodes*

Anaconda Copper Anodes—whether Sheet, Oval, or Electro-deposited—contain less than 0.01 percent of total metallic impurities. This unexcelled high degree of purity pays you with the following advantages:

1 Copper goes into solution faster and more uniformly.
2 The highest quality deposit is produced in the shortest possible time.
3 Slime is reduced to an absolute minimum.
4 Spotting and discoloration of the deposit are eliminated.
5 Scrap losses are exceptionally low.

American Brass produces a complete line of Copper, Brass, and Bronze Anodes . . . rolled Sheet or Oval . . . cut to your own specifications or standard sizes . . . drilled or undrilled . . . with or without hooks—also Electro-deposited Anodes. For present or future reference, write for Publication C-5.

ANACONDA

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Conn. • *Subsidiary of Anaconda Copper Mining Company.* In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

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HERE IS one shortage that actually can give your production a *lift!* It's easy: Take the bull by the horns. Say goodbye to glue. Switch to new, modern GRIPMASTER—the amazing, "years-ahead" polishing wheel cement that boosts polishers' production an average of *47% more* pieces per head! GRIPMASTER contains a secret new high heat resisting ingredient. It does not "glaze" on the wheel. One grade grips *all* grains—250 to 20. Greatly expanded manufacturing facilities guarantee *immediate* shipment.

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POLISHING WHEEL CEMENT

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Please send us a generous free sample of Gripmaster.

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Formulated for tumbling barrel cleaning of small work, all types of metals. Gives a slight foaming action to carry off the heavy grease deposits.
NO. 100 CLEANER
A general soak cleaner for either still tanks or barrels. Leaves no residue to clog perforations in barrels.
NO. 61B DIE CAST CLEANER
A non-etching cleaner for either die cast or aluminum. Can be used for either immersion or machine spray. Very slight foaming action.
Start With A Good Finish
XL ELECTRIC CLEANER
Produces a chemically clean surface at medium temperatures. Special processing eliminates free alkali - No fumes from bath to cause skin irritations.
BD ANODIC CLEANER
For general reverse current cleaning. Adaptable for removal of metallic film in Bullard-Dunn process, commonly called detinning.

Purico Technical Service. The know how to help you in your cleaning problems. A letter will bring you this service.

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THE Puritan MANUFACTURING COMPANY
WATERBURY, CONNECTICUT

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Chicago

"We don't have to buff the copper —it's UNICHROME!"

HARD ALUMINUM TUBING—5,000 pieces of it—carried through the complete plating cycle of copper, nickel, and chromium *without any intermediate buffing at all*—no wonder this company's report is enthusiastic. They were able to eliminate copper buffing entirely with Unichrome Copper!

Think what this means in savings—and in production speed-up. No interruption in the plating cycle to unrack work, no time out in the buffing room, no reracking for the next plating step, no extra cleaning. Of course, on some jobs the base metal condition may require you to do a certain amount of copper buffing. But Unichrome Copper gives you such a smooth plate, that you can buff up the piece much faster, and with lighter pressure. So you still sharply reduce your copper buffing time—in addition to saving copper and buffs.

No wonder Unichrome Copper installations are going into every important metal-working industry—installations that include some of the largest copper-plating tanks in the country. Let us give you details on Unichrome Copper's other advantages, too. Write your nearest Unichrome office.

7 advantages of UNICHROME COPPER

1 Requires less buffing — or none at all.
2 Mildly alkaline—easier on equipment.
3 Non toxic solution — contains no cyanide.
4 Non-gassing — no ventilation necessary
5 Moderate temperatures — cut heating losses.
6 High anode densities—fewer and cleaner anodes.
7 Clean deposits—require no activation.

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Cowles FAST ACTING EMULSION SOLVENT CLEANER

LIXOL works fast and is a dependable emulsion cleaner for still tank, pre-soak or washing machine equipment. It can be used straight or diluted with water or kerosene.

- LIXOL penetrates
- LIXOL cleans thoroughly
- LIXOL prevents rust

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THE COWLES DETERGENT CO.

METAL CLEANER DEPT.

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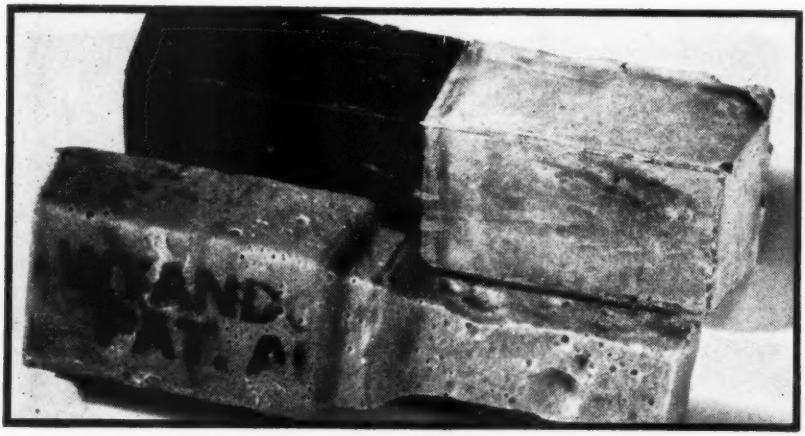
A BUFFING ROOM BOTTLENECK REMOVED

by a new Wyandotte development . . .



. . . a soluble buffing compound that removes readily from buffed surfaces.

Wyandotte Buffing Compound—specifically designed for zinc base die castings and aluminum—eliminates the labor and costs of vapor degreasing and emulsion pre-cleaning . . . and gives excellent results in cutting and coloring operations.

Shown above are two bars of buffing compounds—a Wyandotte bar and a representative competitive bar. Both measure approximately 2″x2½″x8″. Both bars were given identical treatment—(1) 30-minute partial immersion in tap water, 125° F. and (2) 10-minute partial immersion in sulphuric acid solution 2½% by volume, room temperature.

Note the solubility of the WYANDOTTE bar to both water and weak acid solution. The ease with which this Wyandotte compound can be removed should help you with your production problems.

Let your Wyandotte Service Representative demonstrate for you the remarkable quality of Wyandotte Buffing Compound. All you have to do is give him a call.

Wyandotte

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WYANDOTTE CHEMICALS CORPORATION • **J. B. Ford Division**
WYANDOTTE, MICHIGAN • ***SERVICE REPRESENTATIVES IN 88 CITIES***

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- CHROMIC ACID

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270 MADISON AVENUE NEW YORK 16, N.Y.

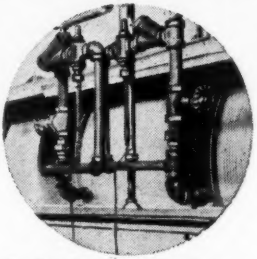
Both heating and cooling of degreaser solvent are made automatic with Sarco VL Vapor Line control and TR-40 cooling control.

Metal Washing TEMPERATURE CONTROLS

When plating and other processes requiring metal washing or cleaning became streamlined and automatic, the need for reliable temperature control became obvious.

On this page, we illustrate four different Sarco controls used for this purpose. Each is positive in action, simple in construction and relatively low in cost.

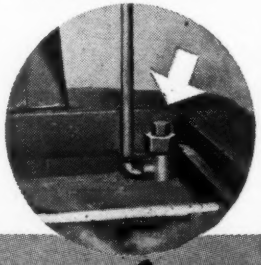
Many manufacturers of washing and degreasing equipment install Sarco control as part of the machine, but it is easily added on existing equipment.



Two Sarco type TR-21 temperature regulators controlling barrel type cleaning machine.

For approximate control on cleaning and rinsing tanks, the Sarco Thermoton costs little more than a steam trap.

Why not let the Sarco Representative near you figure on a simple, inexpensive control hook-up for your plating or degreasing operations?



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Designed for your specific solutions

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STAINLESS STEEL MODELS
for Gray Nickel, Acid Copper Pickling Solutions.

ALL-STEEL (with Stainless Pump)
for Chromium.

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for Copper, Cadmium, Zinc, Indium, Gold and Silver cyanides, and high-speed Copper.

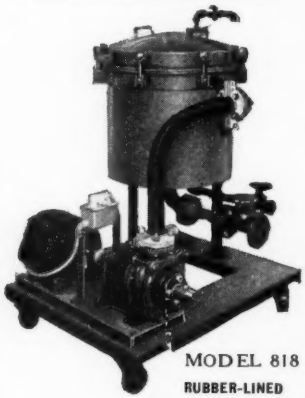
OTHER CONSTRUCTIONS
for Sulfamate Lead, Silver Strike, Gold Hydrate, and other solutions.

• HIGH FLOW RATES • LONG CYCLES • INTERMITTENT or CONTINUOUS FILTRATION • PRESSURE-TIGHT AND LEAKPROOF • AMPLE CAKE SPACE FOR CARBON TREATMENT • LOW COST OPERATION

For accurate continuous addition of filter aid, investigate Sparkler's slurry tank with agitator and proportioning pump.

MODEL No. 1733
RUBBER-LINED
capacity 5,000 G.P.H.

BOOTH F-228
NATIONAL METAL CONGRESS—NOV. 18–22



MODEL 818
RUBBER-LINED
capacity 650 G.P.H.

write

SPARKLER MFG. CO.
273 Lake Street
Mundelein, Illinois

SPARKLER HORIZONTAL PLATE FILTERS

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Many new products now in the planning stage will create finishing problems. Whether you are using metals, plastics or wood, ZAPON has probably dealt successfully with similar questions and has the answer in time-proven products and procedures. Whatever your finishing question may be, a ZAPON representative can help you *now* with the right answer.

IMPORTANT ZAPON INDUSTRIAL PRODUCT FINISHES:

DURANITES* —fast-baking finishes for metal and plastic products.

ZAPONITES* —a complete range of lacquer finishes for wood.

DURELASTO* —new heat curing plastic base wood finish.

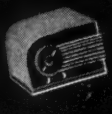
ZAPON LACQUER ENAMEL —pigmented lacquers . . . clear metal lacquers.

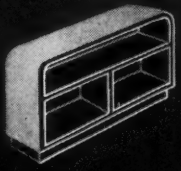
AQUANITE —wood stains.

METALITES* —metalescent finishes . . . air dry and bake.

ZAPAK —package and label coatings and laminating cements.

ZAPON* FABRIC COATINGS





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ZAPON DIVISION
ATLAS POWDER COMPANY

Eastern Sales: Stamford, Conn. • **Western Sales: No. Chicago, Ill.**

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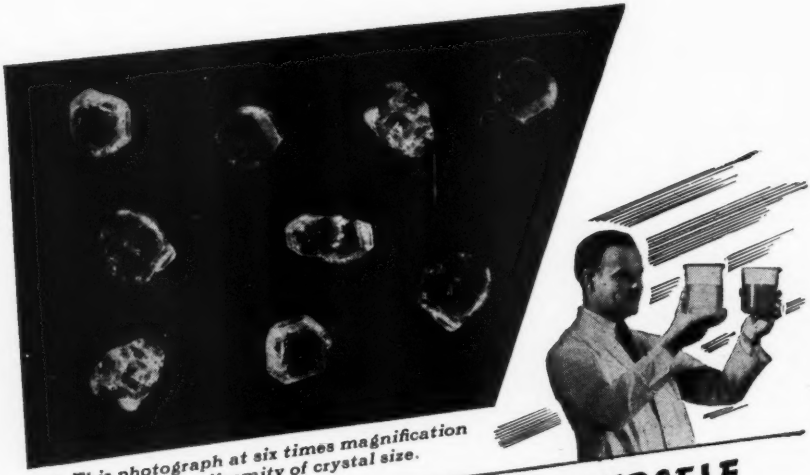

★ *This photograph at six times magnification shows uniformity of crystal size.*

SEE FOR YOURSELF

DISSOLVE SOME OF HARSHAW'S SINGLE NICKEL SALTS

You can easily observe the rapid solubility and freedom from foreign matter in Harshaw's New Single Nickel Salts. • Fill two beakers with distilled water. Pour a small amount of Harshaw's uniformly small free-flowing crystals into one beaker, and a like weight of the old type salts into the other. Hold both beakers up to the light. Watch how much faster Harshaw's New Single Nickel Salts dissolve, and also notice how much clearer the solution remains. • The extreme care used in our unique process for producing these uniformly small $NiSO_46H_2O$ crystals, easily explains their superiority over the old large type crystals. • If you are looking for improved single nickel salts—easily handled in convenient packages—order now from the Harshaw Branch nearest to you.

HARSHAW

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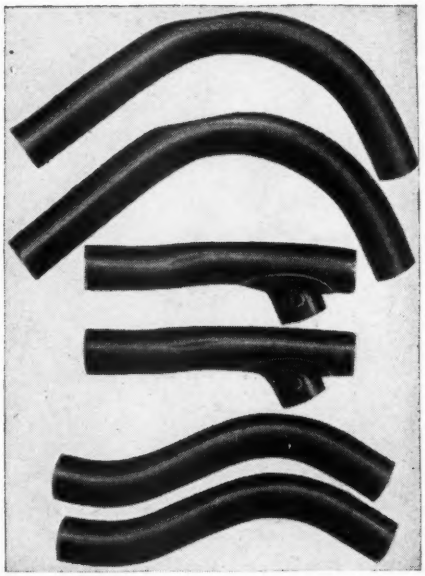

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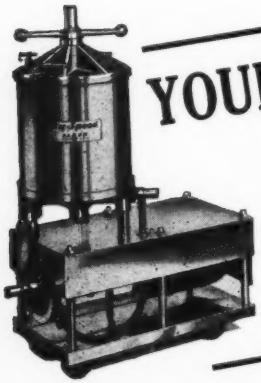

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lower production cost

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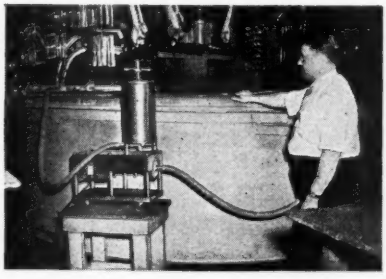

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DETROIT—1947 A. E. S. CONVENTION CITY

CONVENTION NEWS

Mr. George L. Nankervis of George L. Nankervis Company, 5442 Second Boulevard, Detroit 2, Mich., General Chairman of the Detroit Convention to be held on June 23–27 in Hotel Statler, announces the following appointments of Committee Chairmen:

EDUCATIONAL

Dr. R. B. Saltonstall, The Udylite Corporation, Detroit 11, Mich.

EXHIBITS

Mr. H. E. Head, 5547 Fairview Avenue, Detroit 13, Mich.

ENTERTAINMENT

Mr. C. E. Heussner, Chrysler Engineering Building, Highland Park, Mich.

FINANCE

Mr. G. A. Pillsbury, 1104 Nottingham Road, Detroit 30, Mich.

PROGRAM

Mr. B. C. Case, Hanson-Van Winkle-Munning Company, 2842 W. Grand Boulevard, Detroit 2, Mich.

ADVERTISING

Mr. Frank Watt, Frederick B. Stevens, Inc., Third and Larned Streets, Detroit 26, Mich.

HOTEL

Mr. J. E. Bunch, 35345 W. 7 Mile Road, Farmington, Mich.

REGISTRATION

Mr. F. L. Clifton, General Motors Research Building, Detroit 2, Mich.

TRANSPORTATION

Mr. C. L. Southwick, A. T. Wagner Company, 2720 Wight Street, Detroit 7, Mich.

JOB SHOP

Mr. E. Berry, Detroit Plating Industries' 1033 Mt. Elliott Avenue, Detroit 7, Mich.

LADIES

Mrs. G. A. Pillsbury, 1104 Nottingham Road, Detroit 30, Mich.

According to present plans, the Convention will close officially with a Banquet on Thursday night, June 26. Friday, June 27, will be allotted to Plant Visitations.

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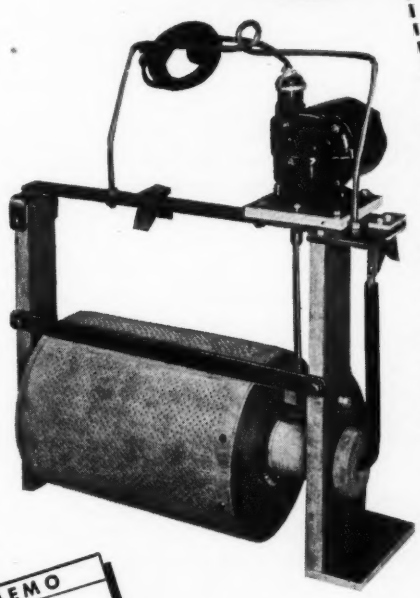

- Can be hung in any plating tank on the cathode rod and operated from the nearest light socket.
- Easy to load and unload because of its extreme portability.
- Nothing plates but the load — no "tree-up" on the cylinder.
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- Specially designed, sturdy, geared-type motor.
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Hundreds of plating shops are finding Lasalco's Utility Barrel Plater a real time saver and profit-maker.

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ELECTROPLATING
for
HIGH SCHOOL STUDENTS

The Philadelphia Branch has long been known for its interest in advancing the science of electroplating.

Its activities in having plating taught in the public schools in Philadelphia, in establishing a complete file of the MONTHLY REVIEW in the Logan Free Library of Philadelphia, and in awarding gold medals to its members presenting papers at the branch meetings, are well known to the Society.

It was only natural, therefore, for this Branch to pass the following resolution at its May, 1945 meeting:

A. Whereas the American Electroplaters' Society is an educational Society, with a philosophy to advance the science of electroplating;

B. BE IT RESOLVED that the Supreme Society of the American Electroplaters' Society use its prestige to have electroplating taught in the Public System of the United States of America along with the other sciences, such as electricity, physics and chemistry.

The Executive Board referred the resolution to the Research Committee for consideration, believing the members of the Research Committee to be in a better position to evaluate the methods of reducing the resolution to a workable procedure.

The Research Committee, in turn, requested Dr. William Blum of the National Bureau of Standards to prepare recommendations to the Research Committee.

The following report was submitted by Dr. Blum at the Research Committee Meeting on September 29, 1945:

Teaching of Electroplating in Public Schools

"At the meeting of the A. E. S. Research Committee on July 14th, a resolution of the Philadelphia Branch regarding classes in electroplating in public schools was referred to the undersigned to prepare and report recommendations to the Research Committee. The following possibilities are suggested for your consideration:

"1. In view of the highly specialized activities and the relatively small number of persons directly engaged in electroplating, the inclusion of a definite course in electroplating in the regular curriculum of most public schools does not appear to be warranted. Such references as are commonly made to electroplating in the present high school courses in physics and chemistry will serve to acquaint students with the principles involved in plating.

"In a few large plating centers, however, a vocational high school could well include a course in plating for one semester, preferably near the end of the high school course, in order to teach those who might decide to go into the plating industry.

"2. It is possible and desirable to stimulate interest of high school students in electroplating by means of one or two lectures each year on the methods and applications of plating. Because few high school science teachers are acquainted with details of plating, such lectures can best be given by some plater or chemist who is directly associated with the industry. Each local Branch of the A. E. S. might well arrange with the local high schools to supply speakers qualified to give such lectures, either to the chemistry or physics classes or to a "science club" that meets after school hours. Such lectures might include slides showing typical plating plants, simple experiments to illustrate the principles, and specimens of plated products, especially those from local industries.

"If there were sufficient interest in such a plan, the A. E. S. could appoint a subcommittee to draw up an outline of such

lectures as a guide to local speakers.

"3. The public schools may also cooperate with the plating industry by furnishing space and facilities for evening classes for platers, to be organized under the auspices of the local A. E. S. Branch. If the school supplies a science teacher, the Branch should cooperate with him in furnishing outlines for the courses which, in successive years might include (a) principles of chemistry, (b) analysis of plating solutions, and (c) more advanced studies in electrodeposition. Here again, the A. E. S. might cooperate by preparing outlines for such courses.

"The principal advantages to the electroplating industry from such educational activities are (1) the attraction to this industry of a larger number of young, ambitious persons, and (2) the advancement of persons engaged in the industry so that they can more readily and more intelligently apply the results of research and development in this field. Both of these aims are eminently proper for the A. E. S.

WILLIAM BLUM."

This report was considered at the Executive Board meeting held in Pittsburgh on March 1, 1946, at which time it was decided that in view of the differences of the operation of local school boards (which would present obstacles to a general committee), the purposes of the Society could be served by following the second recommendation in Dr. Blum's report.

Since it was known that Dr. Blum had presented one-session lectures in the high schools at Washington, D. C., the Executive Board requested him to prepare an outline to be used as a guide for the speakers from the local branch presenting one or two lectures each year on the methods and applications of plating.

Dr. Blum has submitted an outline published on page 1160 which was considered and approved by the Executive Board at its last meeting in Waterbury, Conn.

A copy of this outline has been forwarded to each Branch secretary.

In considering this outline, it should be remembered that it is one that can be expanded by the Branches to suit the conditions of the industrial nature of the area.

If twenty-five per cent of the Branches desire to participate in this activity, the present Educational Chairman will request the Executive Board to consider the preparation of slides to be used in demonstrating operations in typical large installations.

The Educational Chairman will attempt to secure any further information on this subject that may be requested by the Branches and will welcome any comments or suggestions pertaining to the outline.

KENNETH M. HUSTON,
Educational Chairman.

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A. E. S. Research Reports

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OUTLINE OF INFORMAL TALKS ON ELECTROPLATING

For High School Students

BY WILLIAM BLUM

NATIONAL BUREAU OF STANDARDS—WASHINGTON, D. C.

The following outline has been prepared at the request of the Executive Board of the AES. It is based on several informal talks given in recent years by the author to members of a Chemistry Club at McKinley High School in Washington, D. C.

The purpose is to give the students a general picture of the electroplating industry. Especially in large plating centers, such talks may encourage students to take an interest in this field. The following outline may be covered in about one hour, but where conditions permit, two one-hour periods would be preferable. In each specific location it may be desirable to emphasize certain phases and to minimize or omit others.

I. Principles of Electroplating

Explain by a diagram on a blackboard the process of plating, including the generator, tank, solution, anodes and cathodes.

II. Preparation for Plating

Explain the purpose and importance of cleaning and pickling of metal prior to plating.

III. Methods and Applications of Electroplating

For each of the following metals, indicate the types of bath used and the important applications of each metal coating. Show specimens of each deposited metal, preferably on articles made in local plants. If possible, show slides of typical large installations of plating equipment.

Nickel	Cadmium	Copper
Lead	Chromium	Tin
Silver	Rhodium	Gold
Indium		Zinc

IV. Properties and Methods of Test of Plated Coatings

Tell why the following properties are important and describe simple methods for testing them.

1. *Protective Value*—Distinguish between coatings on steel that consist of zinc and cadmium which protect exposed steel, and other (noble) metal coatings which may accelerate corrosion of exposed steel. Refer to salt spray and humidity tests and atmospheric exposure.

2. *Thickness*—Explain that the minimum thickness determines the protective value of both types of coating. Thus, thick coatings of zinc and cadmium last longer than thin coatings, and thick coatings of copper, nickel, silver and gold are less porous than thin coatings. Mention typical specifications, *e. g.*, about 0.001 inch nickel + copper and 0.00002 inch chromium on auto parts, about 0.0008 inch silver on "triple plate" tableware. Thickness is measured by chemical methods and with magnetic gage. Show magnetic gage if available.

3. *Porosity*—Importance of porosity in noble metal coatings on steel. Show specimens tested with ferroxyl test paper.

4. *Adhesion*—Difficult to measure quantitatively.

5. *Hardness*—Importance for wear resistance, *e. g.*, of chromium. Measurement is made by depth of indentation.

6. *Luster and reflecting power*—Important on mirrors. Reflectance is measured.

V. Opportunities for Research

Refer to activities of AES Research Committee at Universities and National Bureau of Standards. Need for more students to specialize in electrochemistry.

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. . . It's Luster-on* Dipped!

The famous Multi-Kwik Beginners' Skates shown here were handled again and again during assembly. Each part of the multiple disc wheels, each stamping which comprises the frame was picked up by many fingers—each ready to leave a tell-tale print to mar the attractiveness of the zinc-plated finish. But there's not a fingerprint in sight!

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Please send me full particulars about Luster-on* bright dip for zinc surfaces. I am (am not) sending sample part for free dip. No obligation, of course.

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Monthly Review November

Horizontal Plating Barrels and Auxiliary Equipment

William H. Jackson

THE UDYLITE CORPORATION—DETROIT, MICHIGAN

BECAUSE successful plating is dependent upon adequate preliminary and subsequent treatment of the articles, all equipment used in the cycle will be discussed and not plating barrels alone.

This article has been divided into two parts. In the first part are treated the various items of equipment which are used. In the second part will be presented various arrangements of the equipment in the form of shop layouts, as well as balancing of the cycle, prevention of solution contamination by drag-in, and use of mono-rail systems, hoists, and bridge cranes.

The substance of this article will be restricted to equipment. Questions pertaining to solutions will be omitted because information about them are either furnished by the supplier of proprietory solutions or can be had in the standard literature.

EQUIPMENT

As is well known, cycles for cyanide plating are very similar to those for acid plating. In fact, the design of the equipment may be the same for both, although the materials of construction will naturally vary to suit the different solutions. Fig. 1 is a general flow chart applicable to most barrel plating in acid as well as in alkaline solutions. A solvent degreasing operation is occasionally employed prior to Item 1 to remove grease or oil from deep recesses; its applicability depends upon the shape and condition of the work. A bright dip, followed by the necessary water rinses, is sometimes inserted between Items 8 and 9. Again, chromate solutions (which produce a protective film on zinc plate) together with the necessary rinses may be added between Items 8 and 10.

At times, a drag-out rinse is used between Items 7 and 8, this being most advantageous when the volume of drag-out from the plating tank runs high, or when an expensive metal is being deposited. When cup-shaped parts or small screws (which hold solution in the threads) are being rinsed, double cold water rinses are beneficial, but a better way is to tumble rinse them.

Referring to Fig. 2, we will now discuss the various pieces of equipment in the cycle.

Item 1, Loading Station

When parts are being cleaned in baskets,

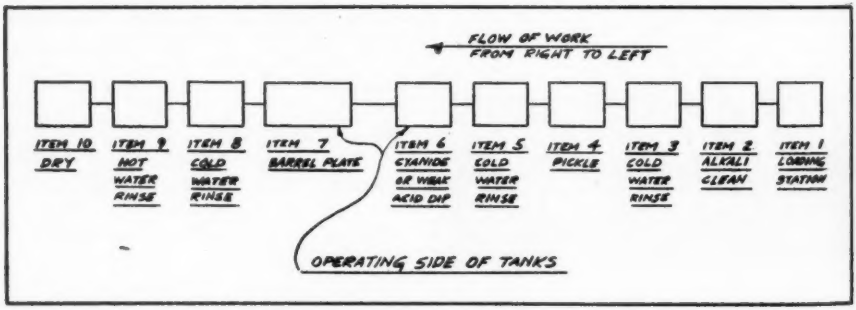
FLOW OF WORK FROM RIGHT TO LEFT
ITEM 10 DRY
ITEM 9 HOT WATER RINSE
ITEM 8 COLD WATER RINSE
ITEM 7 BARREL PLATE
ITEM 6 CYANIDE OR WEAK ACID DIP
ITEM 5 COLD WATER RINSE
ITEM 4 PICKLE
ITEM 3 COLD WATER RINSE
ITEM 2 ALKALI CLEAN
ITEM 1 LOADING STATION
OPERATING SIDE OF TANKS

Fig. 1. General flow chart. Straight line operation

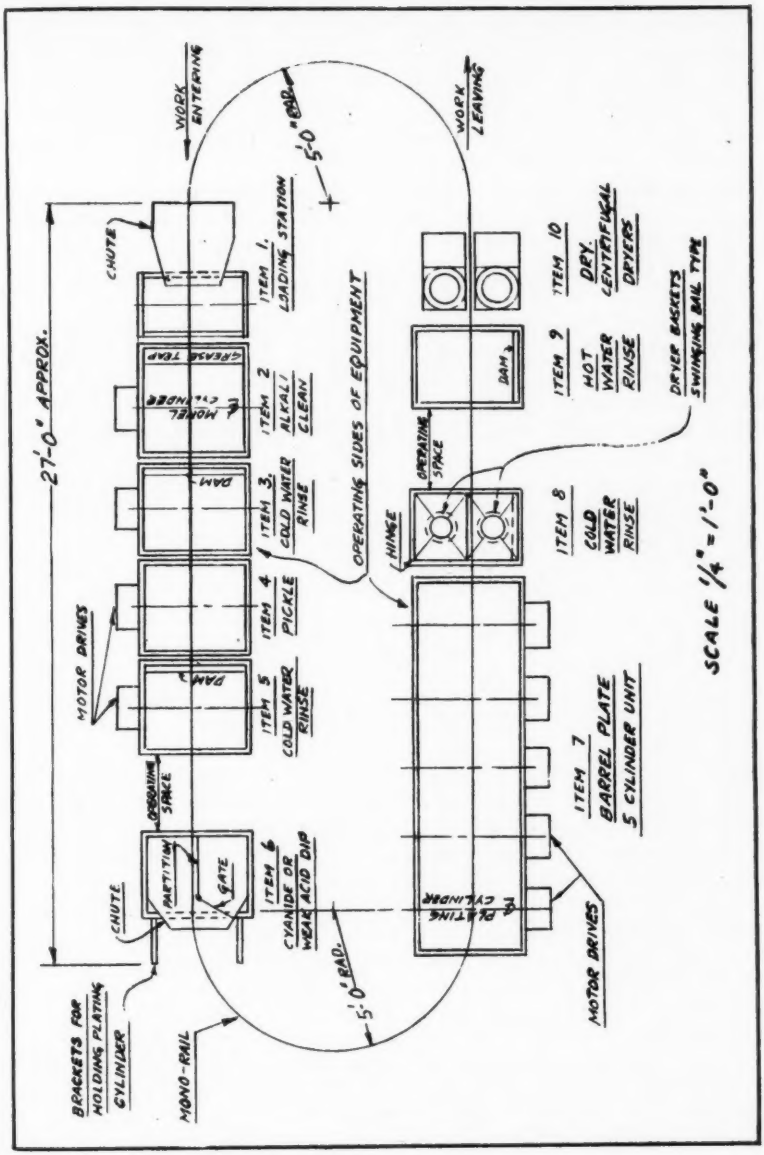

Fig. 2. Return type layout of barrel plating equipment

no equipment is needed at this station—the baskets are simply loaded by hand. However, should the work be processed through the cleaning cycle in perforated monel metal cylinders, both time and labor may be saved by the use of a simple structural steel stand to hold the cylinder in position while it is being loaded from tote boxes. Another variation is to mount a throttled chute on the stand and fill it with work, then raise the chute by means of the overhead hoist on the monorail and dump the contents into the cleaning cylinder.

Item 2, Alkali Cleaner

Work to be barrel plated is, as a rule, either soak cleaned in perforated or wire mesh monel metal baskets or tumble cleaned in motorized, perforated monel metal cylinders. There are times when soak cleaning should be used, such as when tumble cleaning will damage precision parts or when production is small and does not justify the cost of monel cylinders. However, tumble cleaning produces very much better results than does the soak method and is about 400 per cent faster. Small lots of work may be tumble cleaned in an oblique barrel.

In either case, the tank is usually made of steel and equipped with a steam coil or other heating device, ventilating ducts, drains and, last but not least, it may be furnished with a grease trap and circulating pump. The addition of an automatic temperature control is advisable but not vital. It is not uncommon to see the grease from the cleaning tank carried into subsequent tanks, sometimes as far as the plating tank. When a basket or cylinder is removed from the cleaner, the receptacle must pass through any layer of grease which floats on the top of the solution, its presence being evidence to the fact that it is coming off the work. The grease trap and motorized centrifugal circulating pump is used to get rid of most of it. The trap should be located on the side end of the tank and the pump inlet connected to the lower portion of the trap while the pump outlet is joined to a pipe mounted just below the solution level in the tank proper, opposite the grease trap. This pipe has a series of small holes or spray jets and is arranged so that the flow of solution will wash the dirty top layers into the grease trap. The grease trap should be equipped with a drain-off plug located half way up the trap so that the grease may be drained off periodically without disturbing the body of solution in the tank. The pump is usually mounted at the back of the tank, out of the operator's way. The sizes of the pump and of the trap depend, among other things, on the size of the tank.

Electrocleaning. Combined electrocleaning-tumble cleaning has definite advantages for some classes of work over both the straight soak and the tumble methods. The cleaning is improved and the cleaning time tends to be reduced. The work may be made anodic and the tank or, preferably, removable steel electrodes, cathodic.

However, the choice of material from which to construct the cylinder is a problem. A plain, perforated metal cylinder would "steal" most of the current. An insulating coating may be applied to it by the "dip" method which should give fairly good results. A preferred method is to construct the cylinder of one of the plastics which are now available. Such a cylinder requires an automatic temperature control for protection against overheating.

It is poor practice to try to electroclean work in a basket. Because the pieces in the center of the load are electrically shielded, the load will not be cleaned uniformly.

Item 3, Cold Water Rinse

There is not much to be said about this piece of equipment beyond that it is a plain steel tank with a dam overflow and drains. If it has to take a monel metal cylinder, it should be motorized in order that the work be tumble rinsed.

Item 4, Pickle

The operation may be either soak or tumble pickling in sulphuric or muriatic acid. In either case, the tank may be made of steel, preferably lined with synthetic rubber, natural rubber, or plasticized polyvinyl chloride. For sulfuric acid only, a lead lined tank will give a fair length of life. A stoneware crock will generally take care of all pickling needs of small installations. It should be remembered that, in contrast to a polyvinyl chloride lining, a rubber lining is not suitable for such oxidizing agents as chromic or nitric acids. Experience indicates that tumble pickling is some 400 per cent faster than soak pickling; also, the work is more uniformly pickled.

Item 5, Cold Water Rinse

This item may be similar to Item 3, except that the tank should be lined with lead or some other acid resistant material.

Item 6, Cyanide or Weak Acid Dip

For alkaline plating solutions, the tank should contain a weak cyanide solution, while for acid plating, a weak sulfuric solution may be used. This piece of equipment will fulfill four functions: (a) prevent rusting of cleaned work, (b) act as a temporary work storage, (c) act as a means for transferring work from cleaning cylinders to plating cylinders,

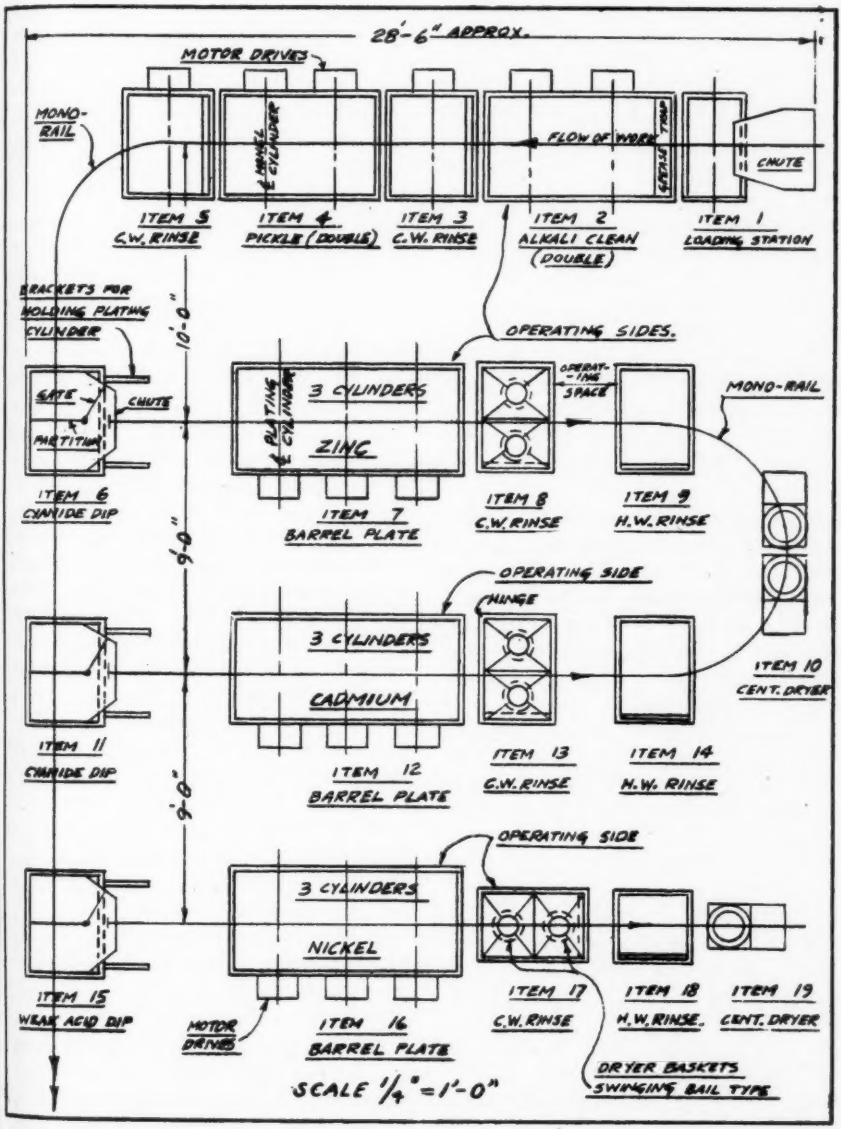

Fig. 3. Layout of barrel plating equipment for deposition of several metals

and (d) bridge the space between two monorail systems whereby the use of monorail switches is avoided (Fig. 3).

When the work is processed through the cleaning cycle in baskets, Item 6 need be only a tank large enough to hold four or six of them.

However, when the work has been handled in monel cylinders, Item 6 may consist of a tank equipped with a perforated chute hinged to the tank and with brackets for mounting the plating cylinder on its side. The parts are discharged from the cleaning cylinders into the chute and, when the latter is raised by the overhead hoist, into the plating cylinders. It is desirable that one or two plating cylinder loads be available at all times. Since monel cylinders are too expensive to be used for temporary storage, the perforated chute may be fitted with a center partition and a gate; the partition will then divide the cleaning cylinder load into two portions while the gate will allow only one portion to be discharged at one time into the plating cylinder.

It should be remembered that when work is put through the cleaning cycle in perforated monel cylinders, there is no surface area limitation on the load as in plating. Hence, one cleaning cylinder load may be made to equal two plating cylinder loads. Item 6 may be equipped with its own hoisting device, such as a pneumatic or hydraulic cylinder attached to the tank and to the chute for the purpose of raising the chute to discharge the work into the plating cylinder. This will save the time otherwise required to bring the overhead hoist around to Item 6.

Item 7, Plating Barrels

Of the standard plating barrels on the market, the 14 x 30 inch size is the most popular. One reason is that it is easy to handle for the average man, another that its normal load, when divided into two equal parts, will be right for the standard 12 x 12 inch centrifugal dryer basket. This point will be discussed in greater detail under Item 8.

Barrels with larger than 14-inch diameter, such as 20-inch diameter, are being used. While a question arises periodically about "shielding" of work in these large barrels, nevertheless, with the proper class of work, speed of cylinder and volume of load, it may give very good results indeed.

Cylinder speed: Speeds between 3 and 6 rpm are best for the average run of work. Low speeds are preferred because with them there will be less abrasion of the cylinder by the parts and the equipment will last longer. Generally speaking, articles which tumble freely, such as nuts and bolts, may be run more slowly than flat articles which tend to stick together when wet. However, a basic requirement is that the work should be tumbled sufficiently to receive an even distribution of plate from piece to piece of the load. Several cases of improper coverage of flat parts have been remedied simply by an increase in the cylinder speed. Some classes of work such as cupped pieces tend to arrange themselves in neat piles or stacks in the cylinder and, under these circumstances, the shielded surfaces in the center of the pile do not become plated. Once more, an increase of cylinder speed will be beneficial; also, two or three pieces of cold rolled steel, about 1 inch in diameter and 6 inches long, put into the cylinder will help break up the load and prevent it from forming into stacks. Glass marbles, about 1 inch in diameter, will do the same thing and have the advantage that they will not plate up.

While on the subject of flat work, it is well to mention that if the inside of the cylinder is serrated or grooved, thin flat parts have far less tendency to stick to the cylinder walls. Of course, in a worn cylinder, the flat surfaces have already been broken by the abrasive action of the work.

Sometimes cylinder speeds of 1 or 1½ rpm are employed to permit barrel plating of precision parts such as accurately threaded articles or ball bearing parts. It is obvious that low speed greatly reduces the abrasion and "nicking" of a

part by other parts in the process of tumbling.

Cathode Contacts: These should be of such a design that they have ample current carrying capacity, will withstand the wear and impact of the load, and can be easily and quickly removed for purposes of cleaning. They should be so positioned in the cylinder as to make good electrical contact with the work, and be constructed in such a manner that a certain amount of neglect of cleaning will not injure the cylinder. It is desirable that they should bury themselves in the load in order that the deposit on them be reduced to a minimum. They should not deform the work. Because the deposit is usually remoevd by hammering, they are usually made of a chromium plated mild steel; stainless steel will also serve. While plating barrel manufacturers seek to design the cathode contacts such as to suit as wide a range of work as possible, nevertheless, one type of contact may be better than another for a given class of work.

Temperature Limitations and Load: Generally speaking, with the materials employed in construction—hard rubber for the cyanide type and canvas bakelite for the acid type—barrels have been limited to operation at temperatures of 160° F or less. If run at a higher temperature, the cylinder may become warped. Therefore, whether or not the temperature of the solution be critical, from a strictly plating standpoint, it is wise to use automatic temperature control to protect the cylinder when fabricated from the foregoing materials. It is pleasing to note that new constructional materials are now available which allow plating barrels to be run at temperatures of over 180° F in both acid and alkaline solutions.

There are also limitations on the size of the load in plating barrels. With average work in a well-built barrel, the maximum load weight will seldom be reached because the maximum surface area of the load will be arrived at before the maximum weight. Since an enormous difference in surface area may exist between two loads having the same volume, no definite rule can be given for the proper size of the load. Such articles as small screws, nuts, washers and pins which have large surface areas for small bulk volumes, should be watched carefully. The size of the load in the cylinder should be smaller than usual and the plating time regulated to suit. With the general run of articles, the cylinder should be loaded approximately half full. Such a load in a 14 x 30 inch size barrel will generally have a surface area of from 50 to 100 square feet and weigh up to 100 pounds. With a larger load, the cylinder will tend to draw more current but, at the same time, the plate distribution on the work will not be as uniform as with the smaller load. Parts weighing more than one pound each should not normally be barrel plated. Long parts, such as bolts 15 or 18 inches long or longer, are difficult to barrel plate and often can be handled better and more quickly in a still tank. Helical springs are usually difficult to barrel plate; they nest badly and take a long time to untangle. There is a rule of the thumb which says that one-third of the load is being plated at each moment. While this rule is approximate, it is of value in estimating the current density on the work to make sure that it is within the bright range of the solution being employed.

Panel Perforations: The panels should be perforated as liberally as possible without weakening them unduly. Thin panels offer less resistance to the passage of the current than thick panels; they also wear out faster and break more easily. Therefore, all factors have to be considered and a compromise made. However, it is good practice to have a constant "open" area in the panels independent of the size of drilling.

Line Voltage: While plating barrels may be run with a line voltage of from 6 to 12 volts, 10 to 12 volts are most popular. Even with the latter, there is seldom danger of burning the work—the continuous agitation of the work and of the solution plus the resistance of the panels

make this possible. A plating barrel is usually permitted to draw all the current it can from the line and hence rheostats are normally not used. If for some reason a rheostat is employed, it should be equipped with a short circuiting switch. It is possible to apply a higher voltage than 12 volts, but additional problems such as burning of the work and overheating of the solution would arise.

Ventilation: Neither the ventilation of solutions nor the degree of ventilation they should have will be discussed here. Suffice it to state that the duct work should be large enough to carry off the vapors and evolved gases and of a design that it will not interfere with the free operation of the equipment. It should either be insulated from the tank at the tank, or have an insulating joint in the run of the duct.

Barrel Productivity: Because the productivity of a plating barrel is measured by the amount of metal it will deposit on the work in a given time, one of the first things one must know in order to calculate the plating time is how much current it is likely to draw. Naturally, this will vary with the kind of solution, its concentration and temperature, the impressed voltage, the surface area of the load, and the overall efficiency. However, experience indicates that the current drawn at a given voltage by a barrel with an average load and in a certain type of bath can be predicted with fair accuracy. The figures gathered in Table I are based upon experience with barrels in the field, and may be taken as an indication of what may be expected in performance.

These figures are conservative and may be some 25 to 50 per cent higher in some cases; such above average performance is something to strive for. They take into account the overall efficiency—both electrochemical and mechanical—of the solution and the machine.

It is worth while to carry out a calculation, for example, for cadmium. Assume a load of 60 square feet, an average thickness of deposit of 0.0002 inch, and an overall barrel efficiency of 85 per cent. According to Faraday's law, an average thickness of 0.0002 inch requires 117 ampere-minutes per square foot at 100 per cent efficiency. At 85 per cent efficiency, 100/85 x 117 = 137.6 ampere-minutes per square foot are needed. This is equal to 60 x 137.6 = 8256 ampere-minutes for 60 square feet. On division by the current drawn, the necessary time is found to be 8256/500 = 16.5 minutes. After a load has been plated for this length of time, samples should be taken and thickness tests made. From the test results, the additional time the work should be run to give the required MINIMUM thickness of deposit can easily be calculated.

TABLE I

PERFORMANCE OF 14 x 30 INCH BARRELS

Voltage: 11 to 12 volts
Load: approximately 60 sq. ft.

SOLUTION	AMPERES DRAWN	TIME PER 0.0001 INCH AVERAGE THICKNESS, MIN.
Cadmium	500	9
Zinc (cyanide)	600	10½
Copper (cyanide)	300	21
Brass	250	25
Silver	300	9
Tin (stannate)	300	29
Nickel (Watts type, warm)	200	40

It may be noted that in this calculation the figure of 16.5 minutes was arrived at for 0.0002 inch AVERAGE thickness of cadmium, while Table I shows 9 minutes for 0.0001 inch or 18 minutes for 0.0002 inch of cadmium. As mentioned before, Table I is approximate and conservative. Its chief advantage is that it shows what current should be drawn under the conditions outlined.

Most plating houses publish tables which supply the length of time required to plate various average thicknesses at

different current densities and at a given current efficiency—all being based on Faraday's law.

Tank Construction: For such cyanide solutions as cadmium and zinc, the tank is usually made of steel. Sometimes the tank is anodically charged and steel anode rods may be submerged in the solution used. Under these circumstances, both the tank and the anode rods and hooks are always clean. However, for stannate tin, cyanide copper and brass solutions, the plain steel tank should be electrically neutral (apart from stray current in the bath) and the anode rods located above the solution level. It might be mentioned here that all current carrying tanks should be insulated from the ground.

For acid plating solutions, it is customary to have the steel tank lined with semi-hard or hard rubber. There are also available on the market plasticized polyvinyl chloride tank linings which are excellent for this application.

Anodes or anode containers for use in plating barrels should be curved to conform to the curvature of the plating cylinder.

Heating and Cooling Means: Steam is by far the most popular and convenient medium for solution heating. Gas and, for small tanks, electric immersion heaters are also used. Excellent tables for the heating of tanks are given in the PLATING AND FINISHING GUIDEBOOK.

Steel steam coils or steel gas flues are used for heating alkaline solutions.

The heating of acid solutions presents additional difficulties. Steam coils of tellurium lead have been widely used. However, considerable uneasiness has been felt concerning their contaminating effect, particularly on solutions containing appreciable concentrations of chlorides or other ions which form soluble lead compounds. There is therefore a distinct tendency among plating shop executives to turn to the carbon type of heat exchanger with a rubber covered steel screen in front to protect it from injury. Since built-in gas flues are used only very seldom to heat acid barrel solutions, the problems which they present will not be discussed here.

The cooling of solutions, particularly of cyanide zinc or of cadmium, offer certain difficulties, especially in the summer time. Steel cooling coils are in general use in the above mentioned solutions, but in some localities the difference between the temperature of the municipal water and the desired solution temperature is so small that water is an inadequate cooling medium. Water from deep wells is generally satisfactory. Vaporizing machines and refrigerating machines have been used successfully but are expensive. Various "home made" devices take advantage of conditions which exist in given localities. Separate cooling tanks have also been employed. Nevertheless, in most plating shops, the use of water as a cooling medium is satisfactory for the major part of the year and, during the relatively few very hot days which are encountered, the production is slowed down, for example by reducing the voltage to lessen the amount of heat evolved.

It is customary to use the water from the coils to supply other tanks in the cycle, such as the rinses.

Coils for current carrying tanks should be insulated, both at the inlet and the outlet.

Item 8, Cold Water Rinse

All know that the plated articles have to be rinsed, but to determine the best way of doing it is often difficult. The work may be rinsed in (a) the plating cylinder, but this is not general practice because of high drag-out losses, (b) the hopper-type rinse unit shown as Item 8 of Fig. 2, (c) the perforated chute-type of unit shown in Fig. 4, or (d) automatic drum-type equipment which may carry it through the remaining operations of the cycle.

Actually, the method of drying the work has a great influence on the design of the rinsing equipment. Because most barrel plated work is dried in a centrifuge, this rinsing station should be utilized to transfer the work from the plating cylinder either immediately into the dryer baskets or into perforated chutes which will later be discharged directly into the dryer. Strange as it may seem, plating

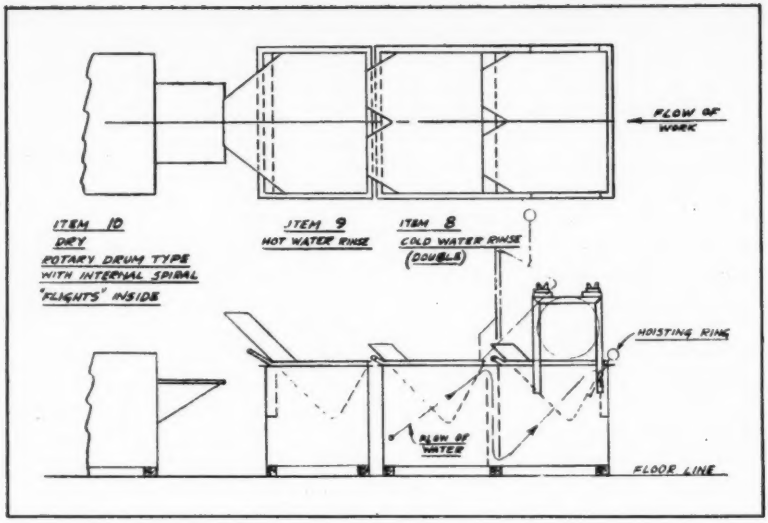

Fig. 4. Plan and elevation of perforated chute type rinsing units

barrels and dryers are frequently bought without consideration given to the size of the load. If centrifugal dryers are used, the plating cylinder load should equal either one or two dryer basket loads. A case in point is the 14 x 30 inch plating barrel; when its normal load is divided into two portions (as would be the case in Item 8 of Fig. 2 by means of the two-hole hopper), each portion will be of correct size for the 12-inch diameter, 12-inch high dryer basket. This is the reason why two centrifugal dryers are shown in Fig. 2. Both the baskets are raised at one time from Item 8 and processed through the rest of the cycle together. With a dryer large enough to take the entire barrel load at one filling of the basket, Item 8 should have a single-hole hopper.

Item 9, Hot Water Rinse

When the work is being rinsed in baskets, this item consists of a plain steel tank with a heating device. Should the tank be equipped with a perforated chute, the latter should have a spout or spouts long enough to discharge the work directly into the centrifugal dryers. In order to keep the rinse water free from rust, the tank may be lead lined, the chute made of stainless steel and the steam coil made of lead or stainless steel.

Item 10, Dryer

As mentioned before, most barrel plated work is dried in centrifugal dryers. Being well known, standard pieces of equipment, very little need be said about them here. It is desirable that they be equipped with heating attachments which provide a hot air blast on the parts; this feature is particularly advantageous when pieces are to be dried which have very small mass per surface area and hence do not pick up sufficient heat from the hot water rinse for complete drying. Another point to be noted is that the size of the wire mesh of the dryer baskets should conform to the size of the perforation in the plating cylinders.

When production is high enough to justify the expense, both time and labor may be saved by the use of a rotating drum type dryer. This machine is equipped with a spiral vane or "flights" on the inside of the drum and with a hot air blast. Because the work is tumbled as it is dried, the machine is particularly suitable for work which tends to trap rinse water, such as cup-shaped pieces, and for flat pieces which stick together when wet. While the drum type dryer will be discussed again, there are two more points which should be mentioned here. The first is that the tumbling may cause precision work to become bruised;

the second, that the moisture tends to dry on the work. Obviously, a centrifuge should be used for drying precision parts, and the rinse water should be kept clean so that impurities from it will not be left on the articles to stain them.

ARRANGEMENT OF THE EQUIPMENT

Because plating departments differ greatly in both kind and amount of equipment as well as in space available for it, an individual layout is usually required for each plant. Nevertheless, there are certain basic features which should be common to all of them. Such factors as the location of doors, aisles and columns and the space available are among the first to be considered, and from them it should be determined whether a straight line arrangement as in Fig. 1 or a return type plan as in Figs. 2 and 3 will be more suitable.

A list of the requirements of a good plating barrel layout includes:

General Requirements

(a) It should permit the work to be processed through the entire cycle with a MINIMUM OF EFFORT ON THE PART OF THE OPERATOR AND IN THE MINIMUM TIME without sacrificing quality. This means that the distances to be covered by the operator are to be kept as short as possible, and the number of transfers be kept to a minimum. (See also the discussion of "One cylinder for the whole cycle" at the end of this article.)

Because most people are right-handed and it is easier for the average right-handed man to work from right to left than from left to right, the layouts shown here have the equipment arranged for right-handed operation. Of course, it may be said that when the cylinders have been unloaded, they must be brought back to the starting point again which involves left-handed operation. This is true, but they are empty and therefore lighter when being pulled from left to right.

(b) There should be NO "BOTTLE-NECKS," i. e., the equipment should be balanced so that adequate capacity exists for cleaning, rinsing and drying as well as for plating.

When estimating requirements for barrel plating equipment, it is customary to begin by determining the size and number of plating barrels required to do a given job, then select the auxiliary equipment for use before and after plating to suit. An example may be in order. Assume that a manufacturing company is to install a barrel plating department and it has been determined that the work will be cadmium plated to an average thickness of 0.0003 inch and that six 14 x 30 inch barrels are needed. This means that the plating time per load will be approximately 27 minutes or, with allowance for loading and unloading, about 30 minutes. The output is, therefore, two loads per barrel per hour or, with six barrels, 12 load s per hour.

With perforated motorized monel cylinders of such size that one cleaning cylinder load will equal two plating cylinder loads, the time schedule in the cleaning cycle may be as follows: (For sake of convenience, the time taken to transfer the cleaning cylinder from tank to tank is included in these figures.)

	MINUTES
Load cleaning cylinder	1
Clean	5
Cold water rinse	2
Pickle	4
Cold water rinse	2
Unload cleaning cylinder	1
Total	15

Thus one cleaning cylinder may be processed through the cleaning cycle four times per hour to produce a total of eight plating barrel loads per hour. Because twelve plating barrel loads per hour are needed, two cleaning cylinders will be required.

In considering the cycle after plating and remembering to look out for "bottle-necks", one finds that one cold water rinse tank can safely handle twenty to thirty loads per hour, which is more than sufficient. Similarly, the work can certainly pass quickly through a single bright dip tank with its accompanying cold water rinses without difficulty. Hot water rinsing is also a short operation requiring only one tank. Depending to some extent on the type of articles being processed, a centrifugal dryer will dry between twenty and thirty dryer basket loads per hour. Since twelve plating barrel loads are to be dried per hour, and each barrel

load should be cut in half for a 12 x 12-inch dryer, the latter has to handle twenty-four dryer basket loads. This is possible, but it is customary, both to save labor and to allow for an increase in production, to have two dryers.

There are a few comments to be made on the foregoing example, especially from the jobbing shop point of view. When the original installation is made, it must be remembered that some classes of work take longer to clean than others and that heat-treated bolts take longer to pickle than soft steel parts. The obvious answer is that larger cleaning and pickling tanks and, perhaps, an extra cleaning cylinder should be provided for job plating shops in which the ratio of plating time to cleaning time is constantly changing. Wide experience indicates that when the plating time is about thirty minutes per barrel load, on the average (1) up to five plating barrels may be supplied with work from a single station cleaner and pickle, (2) from five to ten barrels need a two-station cleaner and pickle and, (3) one cleaning cylinder will prepare enough work to supply either two or three plating barrels.

Another comment has to do with the dryers. Two dryers with 12-inch diameter, 12-inch high baskets were mentioned because this size is most popular. However, one large dryer having a basket working capacity equal to or slightly greater than the load in the plating cylinder will be just as satisfactory. There is a welcome trend in large barrel installations towards rotary drum type dryers. Their capacity in cubic feet per hour is usually given by the manufacturer, but may have to be reduced in order that different classes of work do not become mixed in the drum. Generally speaking (depending on the pitch of the spiral vane and the rpm of the drum) if barrel loads are emptied into the dryer at about two-minute intervals, there will be no mixing.

(c) The equipment should be arranged in such a manner that DRAG-OUT FROM ONE SOLUTION WILL NOT CONTAMINATE ANOTHER. Neither should it fall on such parts as electric motors or electric connections. Fig. 3 illustrates a return type layout with the several metals to be deposited in different lines, all serviced from a common cleaning line. The work flows in the direction from right to left. All the equipment is serviced by a mono-rail system WITHOUT mono-rail switches. An aisle may be provided at the right for the incoming and outgoing work. This layout may be continued downward as indicated to include other metals to be deposited, and the sizes of the plating tanks may be enlarged to suit specific requirements. If necessary, another cleaning line may be added at the bottom, the mono-rail for which should tie in with that shown.

(d) AMPLE AISLE SPACE should be provided and the ELECTRICAL EQUIPMENT, such as motors and rectifiers, SHOULD BE ACCESSIBLE—not jammed against the wall.

(e) LONG RUNS OF BUS WORK from the GENERATORS OR RECTIFIERS to the plating tanks should be avoided. It is well known that these machines SHOULD BE KEPT COOL AND CLEAN.

(f) ELECTRIC HOISTS AND MONO-RAILS. Most barrel plating equipment is serviced by means of mono-rails with electric hoists, although pneumatic hoists are also being used advantageously. Should the mono-rail be curved as shown in the figures, the length of the trolley and the radius of the curve are important. Generally speaking the radius struck by the mono-rail should not be less than 4 or 5 feet. An outrigger arm on the hoist is helpful on the staight-away, but bad on curves. With a curved mono-rail, the outrigger arm will extend toward the point from which the curve is struck, thus putting the operator at a disadvantage when moving the hoist around the curve. Should the arm reach the point, no amount of force exerted by the operator on the arm will move the hoist—it will just bend the arm. Therefore, hoists which must negotiate curves should be moved by pulling the hoisting cable or chain, or else be equipped with power for horizontal travel—the former being more popular. A hoisting speed of about 30 feet per minute is suitable in the handling of plating barrels.

It will be noted that switches in the mono-rails are not indicated in the accom-

panying plating shop diagrams. This omission is intentional because it is felt that switches easily form points of hesitation for the operator and should be avoided whenever possible. If work must be transferred from one mono-rail to another, it is good practice to accomplish this by means of a chute and have the chute perform some necessary operation in the cycle, such as a temporary storage for the work. Items 6, 11, and 15 in Fig. 3 are examples of this with the chute arranged to discharge the work into the plating barrels. If mono-rail switches cannot be avoided, they should be placed so as to service barrels which are on low production runs.

(g) BRIDGE CRANES These are used chiefly to service plating barrels located in the same line in which different metals are being deposited when solution contamination by drag-out is to be strictly avoided. With a mono-rail system on such a single line, the danger of contamination is very great because the various plating cylinders must pass over the tanks while being taken to the loading station or to the rinse. However, with the use of a bridge crane, the cylinder may be passed around a tank rather than over it. For plating barrel applications, the cranes should have a span of about 15 feet which is sufficient to cover two lines of equipment. Perhaps a few comparisons between them and the mono-rail system are in order.

The bridge crane has considerable inertia both at rest and in motion as compared with the hoist on a mono-rail. With the crane, the prevention of solution contamination by drag-out is dependent on the operator whereas with a well designed mono-rail system, it is not dependent on him. The hoist on the crane must be moved in two directions to be positioned over a plating cylinder in order to raise it, but with the mono-rail the hoist is moved in one direction. It can be seen from the foregoing that the hoist or hoists on the mono-rail are easier and faster to operate than is the bridge crane; therefore, the latter should be used only when there is insufficient space to permit the mono-rail system to be employed satisfactorily.

One Cylinder for the Whole Cycle

It was mentioned earlier that the number of transfers should be kept at a minimum. In some shops, the work is actually loaded into the plating cylinder and is processed in it through all the operations of the cycle except the drying. The transfers of work from the cleaning cylinder or basket to the plating cylinder and from the plating cylinder to the rinse chutes are therefore eliminated and floor space is saved. A few comments are in order.

The method has been used for some time in two or three automatic applications of barrel plating, but in the past there has always been the problem of finding a cylinder material which would withstand the various solutions and temperatures in the cycle and at the same time have good abrasion resistance and a long life. Such materials have been developed recently. It is not meant that one cylinder can be used first in cadmium, then in zinc, then in nickel. The cylinder is kept in the line for one metal only. Of course, it may be thoroughly cleaned and then used for another metal.

One of the important problems encountered is that of solution contamination by drag-in; however, this can generally be controlled within working limits. The economics of the method must also be considered. The cost of the drag-out depends on the metal being deposited and the shape of the plated articles. A drag-out rinse may be used. Generally speaking, only when the cost of the labor for transferring is appreciably greater than the cost of the drag-out plus the additional expense occasioned by contamination, is the passing of the cylinder through all the solutions in the cycle worth while. Because the cylinder is equipped with an electrode for contact with the work, the cleaner may be electrified, thus securing the advantages of electro-tumble cleaning. It is realized that some electrochemists "see red" at the thought of passing the plating cylinder through all the solutions; moreover, the industry as a whole frowns upon it. Nevertheless, there are plating shops which do it and claim that they get satisfactory work and have cut their costs, and it is felt that their numbers will grow.

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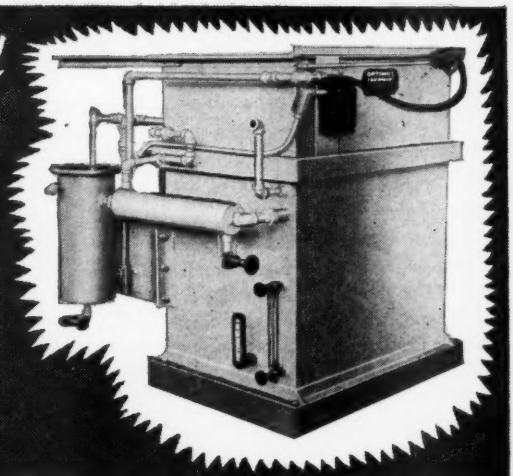

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Adherent and Dense HEAVY SILVER DEPOSITS

By RALPH A. SCHAEFER

Director of Research—The Cleveland Graphite Bronze Company
Cleveland, Ohio

Introduction

With every major technological advance in engine development, a corresponding improvement in bearings usually takes place. The steam engine in the eighteenth and nineteenth centuries saw the development of first the bronze bearings and later the babbitt bearings. At the beginning of the twentieth century, the automotive industry appeared with improved babbitt bearings and later with a variety of new bearing materials such as copper-lead, cadmium-nickel and cadmium-silver alloys.

The rapid advances in the aircraft industry during the war period likewise had its effect on bearing research which resulted in an entirely new all-plated bearing with triplex construction. The shell or backing of steel is electroplated with silver which is machined to very close dimensional tolerances and then precision plated to size with lead and indium. This is the highest load carrying bearing in commercial use today.

Operations

The technical problems associated with the plating of heavy deposits for engineering purposes can be conveniently divided into two groups: first, those pertaining to the steps prior to silver plating which are intended to give uniform and reproducible adhesion and, second, those relating to the silver plating bath which must deposit dense and pore-free silver in thicknesses up to one quarter of an inch.

The chemical operations which are carried out ahead of silver plating include degreasing, electrocleaning, pickling and nickel and silver striking, with suitable rinsing between the various steps.

DEGREASING. The work is degreased in the conventional manner in boiling vapors of trichlorethylene until it approaches the temperature of the boiling solvent.

ELECTROCLEANING. The electrocleaning is carried out anodically at a current density of from 40 to 80 amperes per square foot, depending upon the geometry of the work and the cathode and anode spacing. The electrocleaner is operated at the maximum temperature (the minimum is 40° C) permitted by the masking medium employed. A number of standard proprietary steel cleaners have been used with equal results in concentrations of from 45 to 90 grams per liter for a period of approxmately six minutes.

PICKLING. The work is pickled in 10 to 12% hydrochloric acid at 40 to 45° C for three minutes. This type of pickle gives a definitely etched appearance to the surface. High carbon or alloy steels may require brushing for removal of the black smut. Where any hydrogen embrittlement is undesirable, anodic etching is employed.

NICKEL STRIKING. A modified Watts type nickel bath is used. It is operated at 40 to 45° C and 20 to 30 amperes per square foot, depending on the spacing of the anode and the cathode. The bath composition is as follows:

Nickel Sulfate ($NiSO_4.7H_2O$)	220–300 g/l
Nickel Chloride ($NiCl_2.6H_2O$)	25–40 g/l
Boric Acid	4–12 g/l
Sulfuric Acid to adjust *p*H to	2.0–3.0

The bath is made up and purified continuously by a procedure similar to that described by B. C. Case[1].

SILVER STRIKING. The silver strike is operated at room temperature with six-volt drop betwen anode and cathode and, in order to prevent the formation of an immersion plate, with the work making

electrical connection before it contacts the solution. The strike is for one minute with soluble silver anodes or for two minutes with insoluble steel anodes. It is controlled analytically by a plating and deplating procedure[2]. The solution is filtered continuously and completely replenished when it has plated approximately 50 square feet of surface per gallon of electrolyte. It has the following composition:

Silver Cyanide	0.75– 1.5 g/l
Sodium Cyanide	35–45 g/l
Sodium Carbonate	0–10 g/l

SILVER PLATING. The work is transferred directly to the silver plating units while wet with strike solution. The plating circuit is completed before the articles come in contact with the solution. Whenever the geometry of the part permits, the plating is performed in equipment which has been described in an earlier paper[3]. The electrolyte may be modified to the following composition:

Silver Cyanide	45–50 g/l
Potassium Cyanide	45–50 g/l
Potassium Hydroxide	10–14 g/l
Potassium Carbonate	45–80 g/l
Potassium Nitrate[4]	40–60 g/l
Ammonium Thiosulfate	Addition Agent
Temperature	42°–45° C

The ammonium thiosulfate additions are made at intervals of four hours with a total addition of 0.015 gram per liter each 25 hours. The concentration of ammonium thiosulfate is not critical which gives it a tremendous advantage over the well-known carbon disulfide addition agent. On starting the bath after a shut-down period, 0.015 gram per liter is added since a major portion of the thiosulfate is lost by hydrolysis rather than by electrolysis.

The bath originally proposed[5] was found somewhat unsatisfactory in production on two counts of which the first is related to the variation in the anode and cathode areas and the second to difficulties in maintaining cleanliness in the electrolyte. Within the past two years the engineering usefulness of silver plate has expanded considerably and with these extended applications, the problem of anode control grew more and more difficult. It became apparent that higher throwing power and better anode corrosion were necessary to which ends the above-mentioned silver plating bath was developed by modification in the direction of the Wood bath[6].

In order that the silver plate be kept pore free to microscopic, black light and X-ray inspections, it was found necessary to keep the plating bath so exceedingly clean that it would show approximately the same Tyndall effect as ordinary tap water. This proved very difficult to accomplish in high production because the filtration process was not sufficiently reliable.

The ammonium thiosulfate gave the desired metallurgical properties with practical solution control. The typical silver plate structure obtained with this bath and shown in Fig. 1, does not vary appreciably with the plating conditions.

Fig. 1. Cross-section of silver bearing with extra heavy plate, (0.175 inch thick) etched with ammonia-peroxide. X15

ANNEALING. The plated parts may be annealed at 325° F. or higher to meet engineering specifications. However, contrary to many statements occurring in the litera-

ture, it is not necessary to anneal the plate to obtain excellent adhesion. Generally speaking, at temperatures above 500° F for two hours or longer, silver plate of conventional thicknesses requires a neutral or reducing atmosphere for annealing because it is permeable to oxygen.

In view of the excellent articles already published on lead[7,8,9,10] and indium[9,11,12] plating, no attempt will be made to include them in this paper.

Typical Silver-Plating Flowsheet

Machine
Degrease
Store
Mask—if necessary
Mount on plating racks
Electroclean in warm bath
Rinse in warm running water
Pickle
Rinse in cold running water
Nickel strike
Rinse in cold running water
Silver strike
Silver plate
Dragout recovery
Hot rinse
Remove from plating racks
Remove mask—if used
Anneal—if necessary
Machine

EDITOR'S NOTE: THIS CONCLUDES A SERIES OF ARTICLES ON PLATING OF HEAVY SILVER DEPOSITS WHICH BEGAN WITH HART AND HEUSSNER'S "SILVER PLATING AIRCRAFT ENGINE BEARINGS" IN THE FEBRUARY ISSUE AND CONTINUED WITH MESLE'S "SILVER PLATING BEARINGS" IN THE SEPTEMBER AND OCTOBER ISSUES.

THIS SERIES HAS HAD A TRIPLE PURPOSE: FIRST, TO RECORD AN OUTSTANDING WAR DEVELOPMENT INTO WHICH WAS POURED MUCH THOUGHT AND EFFORT; SECOND, TO PERMIT COMPARISONS BETWEEN DIFFERENT APPROACHES TO PRECISELY THE SAME PROBLEMS; AND THIRD, TO PRESENT MANY OBSERVATIONS WHICH ARE BROADLY APPLICABLE TO OTHER PLATING PROCESSES AND HENCE OF VERY GENERAL INTEREST.

WE ARE GRATEFUL TO THE AUTHORS FOR THEIR COOPERATION.

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A. S. T. M. ANNOUNCES 1947 NATIONAL MEETINGS

The *American Society for Testing Materials* has announced the dates for its National Meetings in 1947 as follows:

1947 SPRING MEETING AND COMMITTEE WEEK—Philadelphia (Benjamin Franklin Hotel), February 24th to 28th.

1947 (Fiftieth) ANNUAL MEETING—Atlantic City (Chalfonte-Haddon Hall), June 16th to 20th.

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Spraying Compositions to BUFFS

By John F. Siefen

THE J. J. SIEFEN COMPANY—DETROIT, MICHIGAN

Summary

A method is described for the application of liquid compounds to revolving buffs in the production of satin and mirror finishes. It is claimed to be more economical than the use of compound bars because of lower consumption of compound and buffs, more efficient utilization of labor and lesser hazard.

Polishing

The development of the spray method of applying compounds to a revolving wheel was due to the desire for a more economical means of recoating polishing wheels and belts.

A fairly heavy coat of a mixture of cold glue (sodium silicate base adhesive) and grain was tried first. It naturally had to be dried overnight at room temperature or in an oven for three hours at 150° F. The method was successful from the start for recoating wheels and belts. Today it permits a set-up man to set up as many as 300 wheels per hour, whereas he used to set up 300 per day.

Soon a thinner coat was found to be ample. What was then more natural than to try it on a revolving wheel? It dried instantly and the operator was relieved of the time-wasting necessity for picking up and laying down of a bar of greaseless compound. Greaseless compound is referred to as it produces the same finish as a thin coat of aluminum oxide grain with cold glue.

At first it was thought that there would be too much waste in spraying, but subsequent tests and production runs have shown that the spray method uses only about 20 per cent of the amount of material removed from a bar of greaseless compound. This is a conservative figure because we have tests on record that show a consumption of as little as two pounds of spray material for each 100 pounds of greaseless compound used previously.

One very obvious reason for this saving is that there are no lumps of compounds being thrown into the exhaust and onto the floor which wastes at least 75 per cent of the bar.

Another reason for less consumption is that cold glue generally adheres better to a wheel than hide glue and, therefore, whether it is satin finishing or rough polishing, the grain is held onto the wheel longer.

One need not doubt the possibility of obtaining a satisfactory finish with cold glue. The grain alone, not the glue, does the cutting, and the glue is only the means of holding the grain on the face of the wheel. If a satin finish is required, the necessary grain size and good flexibility of the buff are assurance of a good finish. Spraying the cold glue-grain mixture in minute quantities gives the required flexibility; and grain size is a matter of choice. Mixtures are made with aluminum oxide in sizes from No. 80 to No. 600—a wide selection.

The spray equipment is standard equipment purchasable anywhere or even found in the factory. The proper tips, needles, and air cap (with pressure type tanks) are necessary but may be varied greatly. Being concerned about the wear on the guns, we ordered carboloy needles and tips but have not used them since the wear on ordinary tips is negligible. The cold glue seems to protect the metal and very little cutting action is apparent.

The kind of wheels is unchanged. They include all types of sewed wheels, loose wheels and string brushes.

Buffing

After several successful installations of the satin finish spray material, it was a relatively simple matter of using the spray equipment to apply compounds that would produce mirror finishes. These compounds must be quite different from the glue-grain mixtures and so there were developed liquid tripoli, stainless steel, grease and nickel buffing compounds—all capable of producing the required luster.

It quickly became apparent that here at last was an ideal way to apply compound.

From 10 to 25 per cent of a hand buffer's time is wasted in picking up and laying down the bar of compound. A conveniently placed foot valve will allow him to produce more work with less effort. On automatic machines, one of several methods is used. Either the operator wastes time which should be used in obtaining more work, men are employed whose sole duty is to apply compound to the wheels, or some mechanical or electrical contrivance is used. Even the best applicators are wasteful and troublesome.

As to hazard, on automatic buffing machines a man or woman has to reach in among the many wheels to apply compound or change bars. Now, it can be done automatically. The spraying of compound onto the buffs will save injury and increase production, due to the elimination of waste motion.

The average saving in buff life on all installations made to date is 30 per cent. There are several reasons for this. First, the buff has the proper cutting head at all times. It is not starved one minute and overfed the next. It is natural for the operator to put off applying a bar until he has to. He won't reach for it until the buff quits cutting. However, an easily accessible foot valve is used more often and the head on the buff is kept in good condition and cutting at all times. Furthermore, the liquid compound seems to cut better.

The can valve on automatic machines is a faithful servant, never varying an instant. The compound is always delivered when needed in the proper amounts.

Friction created by holding the bar against the wheel also accounts for some buff wastage, but what this percentage is we have not determined.

It might appear that if the operator is in a position to spray the compound freely, it will be wasted. On the contrary, the operator will only use enough to keep his wheel cutting. This has been proved during the past year that this method has been in use. Buffers like the new method.

One surprising fact, even to us, is that so little compound is actually necessary to do a good job of buffing. We used to believe that, because so much is used, it was necessary. That is not true. Recall how much goes on the floor and up the blower. A "before" and "after" picture of a buffing machine provides an idea of how clean the spray method really is. When a bar of compound is used, the floor, machine, work, vent pipes and operator are covered with compound and long lint. When the spray is used, very little compound and only a very fine lint is seen. This is proof that there is little waste.

The barrels of "nubbins" in the buffing department that weigh from a few ounces to a pound illustrate another common waste. Some salvage them, but at considerable expense. Many are thrown into the blower or slip out of the buffer's fingers, sometimes with accompanying injury. Spraying eliminates all nubbins.

Records show the average savings in compound consumption to be 70 per cent. In one instance of automatic buffing of aluminum cooking utensils, there were used 110 pounds of tripoli in bar form. Today, with spraying, the consumption is 20 pounds, less than 20 per cent of their former usage. On one hand job, 36 ounces of bar tripoli were used per man per shift. With spraying, one man uses 11 ounces per shift, a saving of over 70 per cent.

The dollars and cents savings are less, because the present cost of liquid tripoli, for instance, is about double that of the ordinary bar of tripoli. However, in time the price will be brought to about that of a high quality bar.

Equipment

Standard spray equipment is employed in

which the fluid is atomized by air and distributed evenly over the surface at which the gun is aimed. Instead of the common trigger operated gun, we use a gun that is air operated. An air piston withdraws the needle of the gun and permits a certain amount of compound to be delivered to the buff in a fine spray. The spray penetrates to an extent depending on the pressure used.

The air which operates the gun is controlled by one of many means. On hand machines, a foot valve is placed convenient to the operator's foot. On automatic machines, a roller cam valve is used. Cams can be set on any moving part of the machine. For instance, on rotary type machines, they can be mounted on the indexing table. The valve may be opened as often as desired depending on the number of cams. On straight line machines, the cam is placed on the work holders. The chain or the work itself may be used to trip the valve. Solenoid valves may also be employed. However, the use of foot valves or push buttons on automatic machines leads to unsatisfactory operation because the operator forgets to use them. Cam valves have been found to be the best.

In most instances, pressure tanks are necessary to supply the gun with compound. Ordinarily, the pressure in the tank and supply lines is not over 10 psi. Depending on the installation, for the atomization, pressures are from 30 to 60 psi. It is possible to use one air line to operate both the air piston and the atomizer but this requires maximum pressures. In other installations, we have used high pressures of from 90 to 125 psi to atomize the compound. Some knowledge of spray equipment is necessary for proper choice and installation. Once installed, it requires very little attention. Daily oiling of the spray guns and the air motor agitator on the tank is all that is necessary.

Difficulties are encountered, but only when instructions are not followed. Most of the present compounds have a tendency to settle if left undisturbed for a couple of days. This problem is being investigated and indications are that compounds will be developed that will not settle. Storage of pails upside down assures faster mixing when a new pail is needed.

Naturally, when compounds settle, they plug the gun. Agitation in the tank overcomes this difficulty, and, if before the start of a shift, the compound in the guns and supply lines is blown back to the tank and then agitated, no trouble is encountered. Once the guns are properly mounted, no change is required except to adjust them for buff wear. This is done in a matter of seconds.

In multiple gun installations, whether on automatic or hand machines, one 10 gallon pressure tank, into which has been inserted a five gallon pail of compound, will supply a dozen or more wheels. It is hooked up to a permanent pipe which is usually $\frac{3}{4}$ inch I.P.S., from which short lengths of rubber hose feed each gun. Since consumption of material has averaged one-half pound per hour, a tankful generally will last two shifts on an eight-wheel automatic.

In other installations, we have installed small gravity feed cups to supply the guns. This is done where consumption of compound per shift is less than the contents of the hose. It is also used for hand machines because of the simplicity of installation. Different types of air caps on the gun are needed for gravity feed and for pressure feed. Here again, some experience with spray equipment is necessary.

The air supply is provided with a second permanent pipe of $\frac{3}{4}$" I.P.S. or thereabout depending on the size of the installation. From this pipe a lead is taken to the cam or foot valve and thence to the gun. Operation is simple: supplying air to the gun lifts the needle valve and atomizes the compound at the same time. Quantity is regulated with an adjustment screw at the back of the gun. It can also be controlled by the pressures of the fluid and air, or by the length of time the foot or cam valve is open.

The width of the spray is controlled by adjustment of the gun and also by the distance from the tip of the gun to the buff. For buffs one inch wide, the gun is placed one to two inches away. For buffs five inches wide, the gun is placed five inches away.

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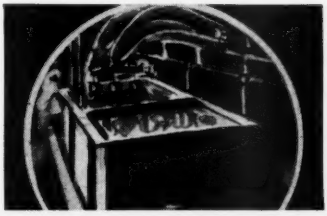

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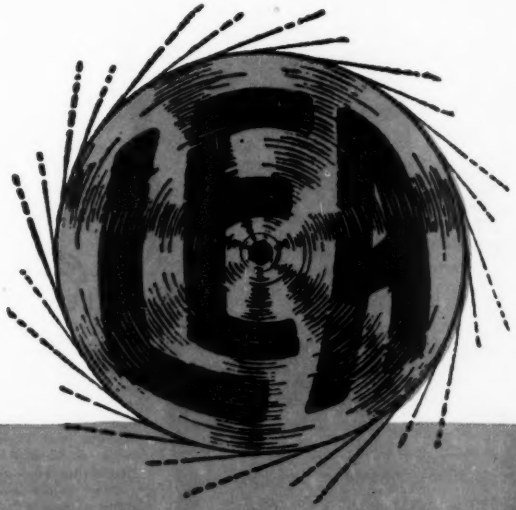

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A. E. S. Research Project No. 2

IV. Iron In Nickel Plating Baths

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In collaboration with
G. FREDERICK SMITH and FREDERICK DUKE

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Iron in Nickel Plating Baths

Summary

Iron is separated from the other metallic ions by precipitation with cupferron. The iron cupferride is extracted with amyl acetate and then returned to the aqueous solution by shaking the amyl acetate extract with 1:1 nitric acid. The iron is then reduced with hydroxylamine hydrochloride, o-phenanthroline is added, and the *p*H is adjusted with sodium acetate. Finally, the light transmission of the ferrous o-phenanthroline complex is measured with a Klett-Sommerson colorimeter.

Introduction

The purpose of this investigation was to develop a rapid, accurate method for the determination of very small amounts of iron in nickel plating baths which also contain appreciable quantities of aluminum, cadmium, copper, lead, manganese, silicon, zinc, calcium, and chromic trioxide (CrO_3).

A literature search indicated that little work had been done on the subject. Thompson and Thomas[18] determined iron in nickel salts used for preparing nickel plating baths by precipitating the iron with ammonium hydroxide and igniting the filtered iron hydroxide. Linick[8] and Foulke and Horner[6] used the reaction between ferric iron and potassium thiocyanate in the colorimetric determination of iron in nickel plating baths.

A rapid, fairly accurate method that did not require expensive equipment or the employment of skilled personnel was desired. Since colorimetry seemed to fit these qualifications best, the various colorimetric methods for the determination of iron were studied.

There are many reagents available which form highly colored solutions with ferrous or ferric iron[17,19,15]. However, few are suitable in the determination of traces of

thiocyanate seems to be in widest usage. Ferric iron reacts with potassium thiocyanate in acid solution to give a red complex ion the composition of which is uncertain. The method, despite the instability of the color and the many interfering substances, enjoys great popularity because of its sensitivity and simplicity[10,11,4,13]. Of the reagents that form colored complexes with ferrous iron, o-phenanthroline, bipyridyl, and 2, 2′, 2″-terpyridyl seem to be the best for colorimetric work. They form red colored complexes in slightly acid solutions that are very stable (6–12 months), very sensitive, and do not require close *p*H control[10,14,7,5,15].

For this investigation, the reaction between ferrous iron and o-phenanthroline seemed most likely to give satisfactory results, and an effort was made to apply it to the determination of iron in nickel plating baths.

In order to familiarize the reader with the conditions under which the ferrous iron-orthophenanthroline color is developed and the effect of various ions on it, a brief summary follows.

The reaction between ferrous iron and o-phenanthroline in slightly acid solutions results in the formation of an orange-red complex having the formula $(C_{12}H_8N_2)\ Fe^{++}$. A plot of the transmittancy versus the wave length of the incident light[15,5] shows that the complex ion exhibits maximum transmittance at a wave length of 508 millimicrons. The color intensity of the complex is independent of the acidity in the *p*H range 2–9. Below a *p*H of 2, the color develops slowly and is much weaker. However, the presence of certain ions alter the *p*H range that can be used. The advantage of being able to work around a *p*H of 2 is that one need not be concerned with the possible precipitation of metallic hydroxides and phosphates.

Of all the 55 ions tested by Fortune and Mellon[5] for their effect upon the intensity and transmittancy of the iron complex, only silver and bismuth, which form precipitates with the reagent, must be absent.

Calcium, lead, manganese and aluminum can be present in amounts up to 500 ppm without causing an error of more than 2 per cent. With sufficient excess of o-phenanthroline, up to 50 ppm of cadmium and 10 ppm of zinc can be tolerated without appreciable error. Nickel changes the hue and hence the transmittance of the solution. Only about 2 ppm of nickel can be present without interference. Ten ppm of copper, 20 ppm of chromate, and 100 ppm of silicate are the maximum amounts of these ions that can be permitted. For a more complete discussion of the effects of these and other ions, the reader should consult the paper by Fortune and Mellon[5].

Development Work

In view of the varying quantities of nickel and other elements in commercial baths, it seemed advisable to find a way to separate the iron from all or most of the constituents present and then develop the colored system.

If cupferron is added to a dilute acid solution, small amounts of iron can be quantitatively precipitated without coprecipitation of any of the other bath constituents except possibly a portion of the copper[2,3,9,16]. To separate the small quantity of iron cupferride from the solution, solvent extraction seemed to be more practical than filtration. Hence, a number of water immiscible solvents were tested to find out which ones would dissolve iron cupferride. Of those tried, amyl acetate seemed to give the best results. Therefore, by addition of cupferron to an aliquot of the bath and extraction of the cupferride with amyl acetate, the iron can be quantitatively separated from the bath.

The next problem encountered was to find some way of getting the iron which is dissolved in the amyl acetate back into an aqueous medium. This can be done by vigorous shaking of the amyl acetate extract with 1:1 nitric acid.

Following this treatment, the iron is in the ferric state and free of interfering ions. The colored system can now be developed in the usual manner by reduction of the ferric iron with hydroxylamine hydrochloride, addition of o-phenanthroline, and finally adjustment of the acidity by addition of sodium acetate. If the *p*H has been adjusted properly, the maximum color will develop

almost instantly. The transmittancy of the solution can be measured as soon as it is diluted and mixed.

The order in which the reagents are added is not of particularly great importance. Fortune and Mellon[5] add the sodium acetate first and then the reducing agent and the o-phenanthroline. Hummel and Williard[7] do likewise. However, Sandener and Schaible[1] showed that the results are somewhat more easily duplicated when the order described above is used. Such was also the writer's experience.

Various reagents have been employed to reduce the ferric iron to the ferrous state. Fortune and Mellon[5] settled on hydroxylamine hydrochloride after testing the usefulness of sodium sulfite, sodium formate, potassium formate, and formaldehyde—none of which gave satisfactory results. Hummel and Williard[7] use hydroquinone.

Tests of Preliminary Procedure

On the basis of the above results, a tentative procedure was outlined. The iron was precipitated with cupferron and the cupferride extracted with amyl acetate. The iron was returned to an aqueous medium by shaking the amyl acetate solution with 1:1 nitric acid. Then the iron-o-phenanthroline color was developed by the addition of hydroxylamine hydrochloride, o-phenanthroline and sodium acetate to the nitric acid solution.

The question now arose as to whether small amounts of iron—say 10 micrograms—could be completely recovered by the proposed method.

To determine the completeness of recovery, 10 micrograms of iron were pipetted into a 25 milliliter volumetric flask and the reagents, starting with 1:1 nitric acid, added in the order given above. The reading obtained for the transmittancy of this solution—after correction for a blank—was then regarded as that which should be obtained for a similar quantity of iron "taken through" the proposed procedure, providing it were capable of complete separation and isolation of such quantities of iron. In Table I are tabulated the observed readings when 10 micrograms of iron were analyzed for by the new method both in the presence and absence of a one milliliter aliquot of a pure synthetic Watts type plating bath. The readings are compared with the "theoretical" reading that should be duplicated if iron recovery were complete.

The data in Table I show that practically all of the iron added is separated and isolated by the proposed procedure even in the presence of the nickel bath aliquot.

TABLE I

Comparison of Experimental and Theoretical Readings

Theoretical reading	33
Reading obtained with proposed method—no nickel bath present	30
Reading obtained with proposed method—in presence of synthetic nickel bath	31

Preparation of Calibration Curve

After it had been demonstrated that iron in a pure nickel bath can be successfully determined by the proposed method, a calibration curve was prepared by adding various quantities of a standard iron solution to a separatory funnel containing a 1 milliliter aliquot of the pure synthetic Watts type nickel bath mentioned above and then following the recommended routine procedure given in detail near the end of the paper starting with step (2). The readings are tabulated in Table II.

By plotting the mean average readings against the corresponding amounts of iron, the curve shown in Fig. 1 is constructed. The resulting straight line shows that Bouguer-Beer's law is obeyed by the iron-orthophenanthroline system over the concentration range tested.

A Klett-Sommerson photoelectric colorimeter with accessory No. 54 green filter was used in the calibration because the wave length band at which this filter transmits the most light—about 525 millimicrons—is close to the band at which the iron-orthophenanthroline system shows the greatest amount of absorption—508 millimicrons. Fig. II shows the transmittancy curves for the filter and the colored system obtained with a Beckman spectrophotometer.

iron. For ferric iron, the reaction with

TABLE II

Calibration Curve Data

Iron Added gamma	Readings	Average Readings	Average Blank	Corrected Average Readings	Mean Average Reading
0	23–19–21	21			
0	20–22–20	21			21
0	17–20–18	19			
10	46–48–47	47	21	26	
10	54–53–53	53	21	32	28
10	49–47–47	48	21	27	
20	94–89–85	89	21	68	
20	67–67–68	68	21	67	62
20	94–95–91	93	21	72	
50	189–186–185	187	21	166	
50	182–182–187	184	21	163	163
50	182–176–179	179	21	158	
100	310–305–315	310	21	289	
100	340–330–325	332	21	311	305
100	335–330–345	336	21	215	

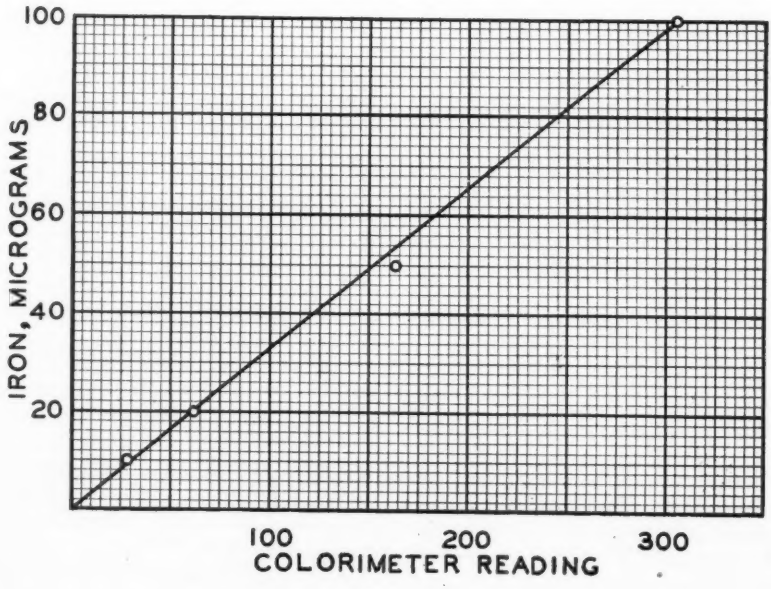

Fig. 1. Calibration curve for the determination of iron in a Watts type nickel bath with o-phenanthroline. Instrument used: Klett-Sommerson colorimeter with green filter No. 54. Type of cell: test tube. Final volume of solution: 25 ml

In the absence of a wave length selector on the instrument, one should always use a filter with a maximum transmission band that corresponds as closely as possible to the wave length band most strongly absorbed by the colored system. In this way, it is possible to attain the greatest sensitivity for the colored system and if the filter's transmission drops off sharply on either side of this band, a minimum absorption due to other ions that may be present.

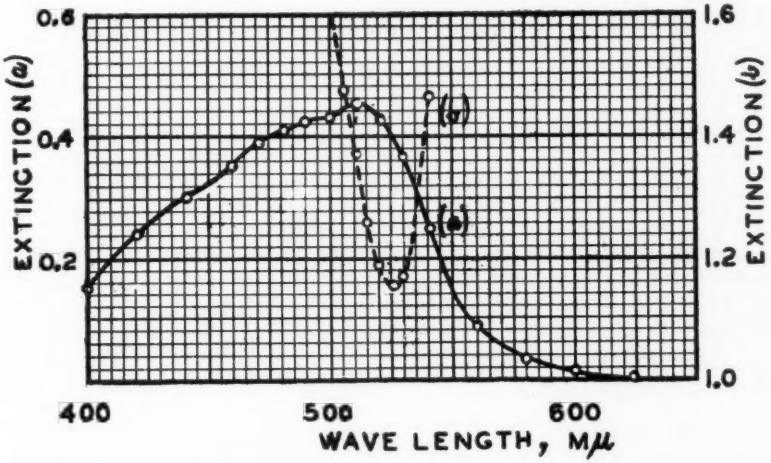

Fig 2. Extinction vs. wave length for ferrous iron-o-phenanthroline complex containing 50 ppm iron. (a) With spectrophotometer, (b) with Klett-Sommerson filter No. 54. The extinction units to the right apply to curve (b)

Accuracy and Precision of Method

A calibration curve being available, the accuracy and precision of the proposed method can now be checked.

To determine the accuracy under conditions similar to those that might be met with industrially, small amounts of various metallic salts were dissolved in 100 milliliters of a pure Watts bath and the accuracy was determined in the presence of these impurities by the same method that was employed in the preparation of the calibration curve.

Table III shows the metallic ions and the quantity of each that were added to the bath, whenever possible as the solid chlorides, sulfates or nitrates. All the salts dissolved except the calcium. The solution was heated, shaken thoroughly and then cooled. It was then filtered to remove the insoluble calcium salts and the filtrate used for the accuracy and precision tests.

Table IV summarizes the accuracy test results on single runs. It is seen that the average accuracy of the method in the presence of the added impurities is about 6% when the procedure is closely followed.

For confirmation, samples of a test solution and copies of the proposed method were sent to several companies for check analyses. The test solution was prepared by

TABLE III

Kind and Quantity of Ions Added to the Plating Bath

Metal Iron Added	Quantity mg	Concentration g/l
Aluminum	100	1.0
Cadmium	100	1.0
Chromic trioxide (CrO_3)	20	0.2
Copper	20	0.2
Lead	5	0.05
Manganese	100	1.0
Silicon	100	1.0
Zinc	100	1.0
Calcium	Saturated	Saturated

adding enough iron to 100 milliliters of the impure bath used above to provide a concentration of 46.5 micrograms per milliliter. The organizations which kindly consented to test this method were the Bethlehem Steel Company of Bethlehem, Pa., Foster D. Snell, Inc., of Brooklyn, and the Bell Telephone Laboratories, Inc., of New York City. Their results and those obtained by the writers are shown in Table V.

TABLE IV

Accuracy Test

Iron Added gamma	Readings	Average Reading	Blank	Corrected Average Reading	Iron Recovered gamma
10	56–56–57	56	21	35	11.0
20	84–88–80	84	21	63	20.0
50	182–178–179	179	21	158	52.0
70	246–305–305	245	21	224	74.0
100	288–305–305	299	21	278	92.0

TABLE V

Results obtained by Various Laboratories Using Proposed Method

Laboratory	Iron Micrograms/ml
Bethlehem Steel Company	46.0
Foster D. Snell, Inc.	46.0
Bell Telephone Laboratories	47.5
Lehigh University	47.0

To test the precision of the method, six duplicates containing 50 gamma of iron were run. Results are shown in Table VI. Precision is only fair, but probably good enough for routine work. Results are generally somewhat high.

Recommended Routine Procedure

REAGENTS REQUIRED:

1. *Cupferron solution—1 per cent.*

Dissolve 0.25 g reagent in 25 ml pure distilled water. Keep the solution cold at all times. Make it up fresh every day.

2. *Amyl acetate—c.p. Grade.*

3. *Nitric acid—1:1*

Dilute the concentrated acid with an equal volume of water.

4. *Hydroxylamine Hydrochloride solution—10 per cent.*

Dissolve 10 g reagent in water and dilute to 100 ml.

5. *O-phenanthroline solution—0.25 per cent.*

Dissolve 0.25 g reagent in 100 ml of water. Warm slightly to hasten solution.

6. *Sodium Acetate buffer solution—20 per cent.*

Dissolve 200 g hydrated sodium acetate in water and dilute to 1 l.

TABLE VI

Precision of Procedure

Iron Added gamma	Readings	Average Reading	Blank	Corrected Average Reading	Iron Found gamma
50	182–178–179	179	21	158	51.8
50	165–167–165	166	21	145	48.0
50	186–184–186	185	21	164	53.8
50	177–178–183	179	21	158	51.8
50	183–183–180	181	21	160	52.3
50	179–182–180	180	21	159	52.0

7. *Synthetic Watts Type Nickel Plating Bath*

330/g $NiSO_4.7H_2O$, g 45 $NiCl_2.6H_2O$ and 30 g Boric acid are dissolved in pure distilled water to make 1 l.

8. *Standard Iron Solution—1 ml = 10 micrograms.*

Dissolve 702 mg ferrous ammonium sulfate, $FeSO_4.(NH_4)_2SO_4.6H_2O$, in 1 l of approximately 0.1 N HCl. Dilute 10 ml of this stock solution to 100 ml and mix thoroughly. 1 ml = 10 gamma of iron.

Apparatus Required

Separatory funnels—two Squibb type short-stemmed funnels of 60–100 ml capacity.

Pipettes and burettes.

25 ml flask.

Klett-Sommerson colorimeter with green filter No. 54 or any other suitable photoelectric colorimeter or spectrophotometer.

Procedure

For routine control work, the following procedure should give satisfactory results if closely followed.

Separation of Iron

1. Pipette 1 ml nickel plating bath into a separatory funnel.

2. Add 10 ml COLD H_2O and then 1 ml COLD 1 per cent cupferron solution. Make certain that both the water and cupferron are cooled to at least 15°C, the lower, the better.

3. Shake for about 1 minute and then allow the solution to stand for 10 minutes. Do not shorten this standing period unless tests have shown that all the iron is precipitated by the cupferron in the shorter time interval.

4. Add 5 ml amyl acetate from a burette, shake for 30 seconds, allow liquid layers to separate, and draw off the bottom (aqueous) layer into another separatory funnel.

5. Repeat the extraction with another 5 ml portion of amyl acetate. Draw off the aqueous layer and throw it away. All the iron has been removed by the amyl acetate.

Isolation of Iron

6. Combine the amyl acetate extracts and wash them with 10 ml water. Again throw the aqueous layer away.

7. Add 2 ml 1:1 HNO_3 from a burette, shake hard for 2 minutes, and run the aqueous layer, after separation, into a 25 ml flask.

8. Shake the amyl acetate layer with 5 ml water for about 30 seconds and run the washings into the same flask. The amyl acetate at this point should be green in color. Discard.

Development of the Colored System

9. Now add in succession with mixing between additions 1 ml hydroxylamine hydrochloride, 2 ml o-phenanthroline reagent and 15 ml sodium acetate solution to the flask. (The last two reagents were dispensed from burettes and the first with a pipette.)

10. If necessary, dilute to the mark with water and mix well.

11. Using a test tube partially filled with water as the reference liquid, adjust the colorimeter so that the galvanometer pointer is at its zero position when the dial reading is zero. If the instrument has a wave length selector, set it at 508 millimicrons.

12. Pour the water out of the test tube, rinse it out a couple of times with small portions of the test solution and then partially fill it with test solution.

13. Put the test tube back in the colorimeter and rotate the dial until the galvanometer reading returns to zero position. Record the scale reading.

14. Run a blank following the above procedure except for the addition of the o-phenanthroline and record the scale reading. (The blank was found to be fairly constant and need only be run from time to time.)

15. Subtract the blank reading from the sample reading to get the correct measure of the light transmitted by the solution. *This method of correcting for the blank is permissible only when the scale readings of the instrument give the extinction of the solution directly or is related to the extinction—i. e., when the scale is logarithmic.*

16. The corrected scale reading is looked

up on the calibration curve and the corresponding amount of iron is that present in the volume of bath originally taken for analysis.

Calculations

Suppose a corrected reading of 158 is obtained when a 1 ml aliquot of the plating bath is used. The corresponding quantity of iron according to the calibration curve is 50.2 gamma.

Hence, in 1 ml of the original solution, there are 50.2 gamma or 0.0502 mg iron. Therefore, in a liter of the bath there will be $0.0502 \times 1000 = 50.2$ mg/l or about 0.05 g/l iron.

As explained in the previous paper on the determination of lead in nickel plating baths, it is possible to eliminate the need for a calibration curve if a solution is known to transmit light in accordance with Bouguer-Beer's law and if the instrument has a logarithmic scale—as does the Klett-Sommerson colorimeter used in this investigation. For procedure and calculations see page 1084-1086 of the October issue.

Discussion of Procedure

Cupferron is usually used at a temperature of 6 C and if means are at hand, the solution and the water should be cooled to this temperature. Small amounts of iron are not completely precipitated by the cupferron from a bath containing none or only small quantities of other impurities if the water and the cupferron are at room temperatures, about 25–28° C. When impurities in the bath are present in the amounts used in testing accuracy and precision, cooling is not necessary because one of the impurities, probably the copper, partially co-precipitates with the iron and assists in its complete precipitation. The addition of an element that can co-precipitate with one present in trace quantities is a common way to get complete precipitation of the trace element. However, since one will usually not know exactly how much of or what metallic ions will be present in the bath, it seems best not to take a chance but to cool the solutions before use.

Tests indicate that it takes appreciable time before the precipitation of iron is complete even when cold solutions are used and a "collector" is present. Ten minutes has been found to give good results. The standing period may be shortened, but one must always make certain that complete precipitation will take place in the chosen time interval. This is one of the critical points of this analysis.

The *p*H of the solution at which the precipitation takes place must be watched. If the acidity is too low, other elements may be precipitated too. If too high, not all the iron may come down. In this study, the solution at the time of addition of cupferron had a *p*H of 2.5. If the *p*H is much lower than this value, it should be raised to within this range.

"Stop and Go" Method

For those desiring only an approximation of the amount of iron in a nickel plating bath, the procedure set forth below is recommended.

The method is based on the yellow to brown color resulting from the solution of the iron cupferride in amyl acetate. The color of the solution is matched against a set of permanent standards each of which represents a definite quantity of iron. The sample then contains an amount of iron equal to that represented by the standard it most nearly matches in color.

The permanent standards are prepared from the following solutions:

a. potassium dichromate—5.0 mg chromium per ml
b. cobalt chloride—59.59 g $CoCl_2 . 6H_2O$ per l in 1 %HC_1
c. ferric chloride—45.05 g of $FeCl_2 . 6H_2O$ per l in 1 % HCl

The quantities of each solution that are used are so chosen that their resulting colors appear to be the same as those produced by solutions of 10, 30, 50, 80 and 100 micrograms of iron respectively dissolved in 5 ml of amyl acetate as iron cupferride. The quantities required are given in Table VII.

RECOMMENDED PROCEDURE

1. Follow the recommended routine procedure given for the accurate determination of iron up to and including step (4).

TABLE VII

Preparation of the Permanent Standards

Iron equivalent—micrograms	10	30	50	80	100
$K_2Cr_2O_7$ solution, ml	2.5	....	....	....	....
$FeCl_3.6H_2O$ solution, ml	....	11.2	18.6	28.5	35.7
$CoCl_2.6H_2O$ solution, ml	1.2	2.3	3.8	5.6	9.1
H_2O, ml	74	20	15	...	...

2. Wash the amyl acetate twice with 5 ml portions of water.

3. Run the amyl acetate solution into a small Nessler or test tube.

4. Compare the color of the unknown with the colors of a set of permanent standards prepared as indicated in Table VII. Five ml of each solution is put into a tube of the same size and shape as that containing the unknown. The comparison is best made by viewing the tubes laterally against a white background under a fluorescent light if one is available.

5. Find the standard which most nearly has the same color as the sample. The amount of iron represented by this standard is then approximately the amount of iron in the sample.

The method—if properly followed—should give an accuracy of about 0.015 to 0.020 g/l of iron over the range tested.

Keep the standards in lightly stoppered tubes. They will last over a year if properly sealed. By this time, an operator will most likely be able to estimate the iron content of samples without reference to the standards.

Applicability to Other Nickel Plating Baths

The procedure has been tested on chloride, 50–50 and high sulfate nickel plating baths and found to give satisfactory results.

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RESEARCH COMMITTEE MEETING

The Research Committee meeting at the Waterbury Club, Waterbury, Conn., was held on Friday, September 13, 1946. All members of the Committee were present with the exception of DR. H. L. KELLNER who was represented by W. CASSELL. In addition, Vice-Presidents K. M. HUSTON, S. S. JOHNSTON and A. W. LOGOZZO, representing the Executive Board, and C. H. SAMPLE, liaison member to A. S. T. M. Committee B-8, were present.

The next meeting of the Research Committee is scheduled for 9:30 A. M., Friday, December 13, 1946, at the Hotel Statler, Detroit, Mich.

Vice-President K. M. HUSTON submitted a revised draft of the A. E. S. Facts and Chairman E. T. CANDEE and DR. R. A. SCHAEFER, representing the Finance Sub-Committee, were requested to submit any suggested changes in the draft pertaining to research data to Mr. Huston.

Mr. C. E. HEUSSNER, Chairman of the Finance Committee, outlined the plans of the Committee for the coming year. DR. R. A. SCHAEFER and DR. H. L. KELLNER are actively engaged in carrying out these plans and the members will be informed of the progress of this Committee's activities through the various Branches during the months immediately ahead.

MR. C. H. SAMPLE and the Secretary reported on the progress of their negotiations with the A. S. T. M. to obtain joint recognition in connection with the publication of plating specifications, as authorized at the Annual Meeting in June. Considerable progress has been made and a report will be forthcoming in the near future.

It was reported that A. E. S. Reprint No. 2, a continuation of "Adhesion of Electrodeposits" by Dr. A. L. Ferguson, is now available. This reprint consists of 40 pages and sells for 40 cents per copy. Together with Reprint No. 1, the information presented in these reprints represents the entire report on Project No. 3 as it appeared originally in THE MONTHLY REVIEW during the past year. It is felt that many members and organizations will wish to have copies of these reprints for their libraries.

DR. R. M. WICK submitted a very complete report for the Project Directing Sub-Committee briefly summarizing the status of the various projects. Projects No. 1 and No. 3 have been completed for the present. Project No. 4 on "The Effect of Surface Finishing of Non-Ferrous Base Metals on the Protective Value of Plated Coatings" has not as yet been established although progress is being made. Project No. 9 on "The Properties of Electrodeposited Coatings", which is to be located at the National Bureau of Standards with DR. A. BRENNER as Project Director, will be started as soon as a competent fellow can be engaged. DR. WILLIAM BLUM is Chairman of the Project Directing Sub-Committee.

A new Project, No. 10, on "The Disposal of Plating Room Wastes" is planned. This very important and timely subject will very likely be investigated in a New England location.

During the coming months reports from the other Projects will be available for publication in THE MONTHLY REVIEW. In accordance with the established policy of the Research Committee these reports will subsequently be made available in reprint form and should constitute a very valuable library on subjects pertinent to electroplating and metal finishing.

The Research Committee has requested the Detroit Convention Committee to reserve two Educational Sessions for the presentation of the Research Committee reports at the 1947 June Convention. In making this request for additional time, it is the desire of the Committee to provide sufficient time in the Sessions for adequate presentation and discussion of the results of the research work.

Vice-President M. R. CALDWELL was requested to keep in close touch with the Detroit Convention Committee in order to arrange for participation of the Research

Committee in the exhibits at the coming convention.

A letter was read from the Secretary of the Materials and Processes Group of the General Motors Corporation addressed to the Executive Secretary, commending the Society on its investigation of the effect of surface treatments on zinc-base die castings on protective value of plated coatings (Project No. 4) and offered any assistance required from the corporation.

Many other matters pertaining to policy, organization and the finances of the Research Committee were discussed.

After a very busy day the meeting adjourned at 4:30 P. M. The members and guests were then driven to a delightful Inn on the outskirts of Waterbury where they were the guests of the American Brass Company for dinner. After dinner the group was driven back to the Elton Hotel and attended a very interesting meeting of the Waterbury Branch, the members of which proved to be gracious hosts to both the Research Committee and the Executive Board, all of whom were present for their meeting the following day.

EXECUTIVE BOARD MEETING

The Executive Board, with 100 per cent attendance, met at the Waterbury Club, Waterbury, Conn., on Saturday morning, September 14, 1946. The meeting was called to order at 8:30 P. M. by PRESIDENT SAVAGE and, with the exception of one hour out for lunch, the Board labored long and diligently on Society matters until 5:00 P. M. Among the matters taken up by the Board, the following should be mentioned as being of considerable interest to the members of the Society.

Under the energetic leadership of Vice-President K. M. HUSTON, further efforts to obtain back volumes of our Society's publications are under way. This effort is being coordinated with the Society's program for equipping libraries with complete files of our publications in all Branch cities and other selected centers. VICE-PRESIDENT HUSTON is planning to push this matter during the coming year enlisting the active cooperation of the Branches.

Past President W. L. PINNER, Chairman of the Committee on the revision of the Constitution, is busily engaged compiling information and reported that a meeting of his committee has already been scheduled for early in October. This is a very difficult and important assignment and the Society is fortunate in having entrusted this responsibility to one of his capabilities.

The Executive Board approved the request of the Detroit Convention Committee to hold a manufacturers' exhibit and enthusiastically indorsed the preliminary convention plans as reported by Chairman GEORGE L. NANKERVIS.

The *A. E. S. Facts*, a publication describing the scope of the activities of the A. E. S., is being revised by Vice-President K. M. HUSTON with the cooperation of the Research Committee, Executive Board and Executive Secretary. It is expected that revised copies will be available for distribution within a very short time.

The Secretary was instructed to purchase 100 copies of the joint A. S. T. M.-A. E. S. specifications for resale to members of the Society. These will be available shortly at the A. S. T. M. price of $1.25 per copy.

Vice-President S. S. JOHNSTON reported that the final financial statement for the 1946 June Convention was not yet completed, awaiting the settlement of a few advertising accounts. It was very gratifying to the Board and it should prove equally so to the members to learn that in spite of the many difficulties the Pittsburgh Convention will produce a profit to the Society. This is further testimony as to the efficient handling of the convention by the Pittsburgh Branch.

The Executive Board approved a price of $6.50 for the 1946 volume of the *Annual Proceedings* to non-members. The Secretary reported that the *Proceedings* would be mailed to members some time in November, the delay being caused by the shortage of paper and the increased number of volumse required by our enlarged membership.

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Is Your Plating Bath as Clean as the Water Used in Your Final Rinse?

By KENNETH M. HUSTON

Chairman, Program and Educational Commiittee

Dry Process Enameling Practice I. Frit Manufacture

W. J. BALDWIN. *Finish*, **3**, 19–21 (May 1946).

Discusses frit composition; four steps in frit manufacture: mixing, smelting, fritting, drying; and storage of the frit.

●

Pickling and Bright Dipping Copper-Zinc Alloys

GEORGE B. HOGABOOM. *Metal Finishing*, **44**, 198–201 (May 1946).

Discusses pickling, scaling dips, bright dips and neutralizing.

●

Passivity of Metals

JACQUES LIGER. *Galvano*, No. 111, 10 (1944).

The heat from polishing operations causes the formation of a thin, invisible oxide layer which will render a metal surface passive if not completely removed by thorough buffing. Alkali cleaning baths will passivate surfaces unless a current is flowing. Objects taken from the cleaning bath should be rinsed in fresh, flowing water. After rinsing, the objects should be placed immediately in the plating bath and not left in contact with the air. (EDITOR'S NOTE: An acid dipping treatment would help.)

J. S. FRITZ.

●

Reprocessing Porcelain Enameled Parts

E. E. HOWE. *Better Enameling*, **17**, 6–8 (May 1946).

Discusses the development of a special enamel and outlines properties essential for a patching enamel.

●

Controlling Hydrofluoric-Nitric Pickling Baths

ANON. *Steel*, **118**, 110–112 (June 10, 1946).

Testing has been expedited by rapid methods of analysis, reducing need for bath replacement and saving much time.

●

Small Parts Plating

WILLIAM EHRENCRONA. *Die Casting*, **4**, 60, 62, 64, 66 (June 1946).

Well integrated, continuous-line operation utilizing automatic equipment speeds up plating on automobile accessory parts.

Electrostatic Coating Processes

ARTHUR P. SCHULZE. *Organic Finishing*, **7**, No. 6, 9–22 (1946).

Electrostatic detearing provides a method that automatically frees the part or product being processed of excess coating material that results from draining after the dipping operation and thereby presents to the oven a uniformly coated surface which can be adequately baked to a uniform finish. Supported on and electrically grounded by any of the usual types of conveyors, the article is dipped or flow-coated, passed over the usual drainboard which returns most of the excess paint to the tank, and allowed to set sufficiently so that the flow has virtually stopped. Then it goes through a strongly attractive electric field established between the grounded article and an insulated conducting grid to which a static high voltage is applied and over which the dipped piece passes. This force is particularly strong at points or prominences where drain-off is most likely to occur. Because of this attraction, excess paint is removed from these points on the work, leaving a smooth coating ready for a standard baking schedule. The source of the electric field is a specially designed voltage pack that produces 85,000 volts pulsating direct current from the usual 220v, 60 cycle line. In general, the time required for detearing most items runs between 15 secs and 1 minute. In the process of electrostatic spraying, an electric field is created about the item by the 85,–100,000 v of pulsating dc, applied to the insulated electrodes at the spray position. The electrodes impart charges to the finely atomized paint particles sprayed into this field from fixed guns, causing the particles to be attracted and deposited on the piece with minimum loss of finishing material, as well as producing a coating of extreme uniformity. The work is generally rotated to insure uniform coating even thought paint is drawn to all sides simultaneously.

L. A. SEABRIGHT.

Buffing Small Parts

H. MOORE. *Metal Finishing*, **44**, 247, 253 (June 1946).

Discusses methods of holding small parts.

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What's Wrong in Some Finishing Rooms

C. RAYMOND SYER. *Industrial Finishing*, **22**, 66, 68, 70 (May 1946).

Cleanliness needed in every paint department; check the air pressure; strain

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Properties of Saran Coating Latex

G. W. STANTON and W. A. HENSON. *Ind. Eng. Chem.* (Ind. Ed.), **38**, 468-472 (May 1946); *Corrosion and Materials Protection*, **1946**, No. 4, 6–12.

The Saran coating latices are collodial dispersions of solid polymer in water. The particle size is very uniform and small ranging from approximately 0.08–0.15 micron. The solids content can be made as high as 60 per cent without sacrifice of particle size or distribution. The variation of specific gravity and viscosity, respectively, with increased solids content are shown. The specific gravities were determined with standard hydrometers and the viscosities by the capillary method. The Saran coating latices are somewhat sensitive to coagulation by electrolytes and water miscible organic liquids. Infinite dilution of the latex with hard water produces no coagulation or unstablizing effects. In common with other water dispersions, the Saran latices show greater stability in contact with certain metals than with others. Listed below in order or preference are representative metals found to be satisfactory for processing and handling the latices (pH adjusted between 5 and 8): Stainless Steel, Chromium, Tin, Bronze, Brass, Nickel, and Aluminum. Metals such as black iron and mild steels which are quite readily corroded are unsatisfactory; however, these surfaces are satisfactory if coated with a water impermeable finish, such as one of the Saran coating

resins in the form of a latex or in organic solvent solution. The viscosity of the latex usually marketed, is approximately 22 centipoise at 57 per cent solids. This can be raised to any desired viscosity by the addition of very small amounts of available thickeners. Free films were prepared from commercially available Saran F-115 latex by adding 5 to 25 per cent of plasticizer in water emulsion and sufficient thickener to give a good casting viscosity, approximately 1,000 centipoise. The latex was then poured onto a glass plate, knifed evenly over the surface and allowed to air dry until clear. Films containing 15 per cent or less of plasticizer will show improved physical properties if heated a few minutes at 100° – 110° C. The waterproof nature of the dried Saran latex coating is useful for providing protection to water for wallpapers, shipping containers, gummed tape backings and specialty products. Its application to paper twine and fiber cord markedly increases its strength and durability by reason of the deposited plastic film. Woven paper cord thus treated is easier to clean and more resistant to soiling.

L. H. SEABRIGHT.

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Notes on Commutator Design

M. A. PRINCE. *Plastics* (American), **4**, 30, 32–33, 97–99 (April 1946).

Metal-plating polystyrene is a speedy and economical way to make commutators of complex shape or with many segments or connectors.

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Diffused Nickel-Zinc Coatings

GEORGE BLACK. *Metal Finishing*, **44**, 207, 209 (May 1946).

Nickel-zinc offers superior protection and is especially useful where severe corrosive conditions resulting from moisture, fumes, brines and heat are to be encountered. The nickel-zinc coating process is discussed in detail.

Corrosion Resistance of Stainless Steels

M. MARGOLIN, M. SACHNOVITCH, and I. JUSVINSKAYA. *Iron Age*, **157**, 50–55 (May 23, 1946).

Results of decarburization tests on high carbon 13 per cent chromium steels conducted by Russian investigators with the two-flold intention of removing carbon from surface layers to obtain good corrosion resistance and retaining carbon in the core to preserve the strength of the steel, are described.

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Nickel Dipping

G. H. McINTYRE. *Foundry Trade Journal*, **79**, 9–11 (May 2, 1946).

Advantages and disadvantages of nickel treatment covered. Advantages claimed are reduced copper-heading, better bond of ground coat to base, more uniform steel surface texture and prevention of fish-scaling.

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Electrostatic Spraying

EMERY P. MILLER. *Industrial Finishing*, **22**, 30, 32, 34, 36, 41–42 (May 1946).

Describes electrostatic spraying, how it differs from a regular automatic spray-painting set-up, what happens when paint is sprayed in an electrostatic field, what kinds of paints and products to be painted will work effectively and the merits of electrostatic spraying in production painting.

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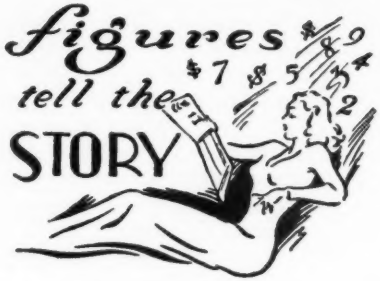
Production Plating of Zinc Die Casting

HERBERT CHASE. *Iron Age*, **157**, 34–38 (May 30, 1946).

Bright copper-nickel-chromium plating of zinc die castings on a high production basis at the plant of the Electric Auto-Lite Co. is described. Solutions, current densities and conveying arrangements are discussed in considerable detail.



It Always Pays to Keep Corrosion Costs Down

CORROSION never takes a holiday nor remains idle over a week-end. It keeps everlastingly at the business of piling up costs without helping production.

Yet corrosion is unnecessary; it can be stopped before it starts—by using the right material in each case, and by high quality welding which leaves no minute pockets where corrosion can start. Your own conditions may call for some corrosion-resistant alloy throughout, or for a lined job or a clad job. Storts has had many years of experience in all of these types of construction. Let this experience help you in your planning of future equipment.

STORTS WELDING COMPANY

42 Stone Street Meriden, Conn.

BRIDGEPORT BRANCH

The regular monthly meeting was held Friday, September 6 at the Hotel Barnum. There were 34 members and guests present.

RAY J. KWASNIK, Chairman of the Outing Committee, reported that an outing had been arranged for Saturday, September 21 in Eichners Grove, Trumbull, Conn., with plenty of food, refreshments, fun and, we hope, sunshine.

President H. M. GOLDMAN appointed R. J. KWASNIK and A. R. MCNEIL to assist F. B. GOTTHARDT on the Meeting Place Committee which was given full power to act.

C. L. TEMPLE, Chairman of the Membership Committee, presented two new applications for membership and one for balloting. There was also one resignation and one suspension.

HERMAN BRAUN of the Sick Committee reported that Sergeant-at-Arms JAMES MCGRATH'S son is ill.

CARL SCHAEFER, Chairman of the Technical Sessions Committee, reported that the first open meeting of the season will be held on October 18.

Delegates A. R. MCNEIL, H. C. BRAUN and J. G. STERLING as well as RALPH MCCAHAN presented a final report of the Pittsburgh Convention and were happy to announce the election of ARTHUR LOGOZZO of the Hartford Branch as A. E. S. Third Vice-President. He was nominated to this office by our old time friend, GEORGE B. HOGABOOM of New Britain, Conn.

JOSEPH G. STERLING,
Secretary and Treasurer.

GRAND RAPIDS BRANCH

The members of Grand Rapids Branch held their first meeting of the season on Friday, September 13, at their usual gathering place, the English Room of the Rowe Hotel.

We were fortunate in having as our speaker, MR. C. W. SMITH, "Chet" to his friends, who presented his prize-winning paper, "The Practical Value to the Plater of Film Analysis by the Electron-Diffraction Technique," with accompanying lantern slides. It aroused a great deal of interest in the audience of about seventy members and guests. Mr. Smith was generous with his answers in the discussion which followed.

Moving pictures of big game hunting and fishing were shown before the address, and the regular lunch, served by the hotel, completed the evening.

RANSOM B. PERKINS, *Secretary.*

LANCASTER BRANCH

The regular monthly meeting was held September 13 at the Stevens Trade School. It was called to order by Vice-President THEODORE SCHWALM.

"Practical Application of the Ampere-hour Meter" was the subject of a talk by MR. CLARENCE BOERCKEL of the Reynolds-Robson Supply Company. The instrument resembles the Watt-hour meter except that it records the ampere-hours. It consists of a shunt, placed in series with the plating circuit, to which is attached the meter.

There are several types of meters—indicating, totalizing, and a combination of both. The indicating type signals (by bell

or light) at the conclusion of a pre-determined number of ampere-hours. The totalizing type maintains a dial record of the number of ampere-hours over a period of time. The combination indicating and totalizing meter combines both functions and gives both results.

The ampere-hour meter serves to control:

1. Thickness of the specification deposits of expensive metals such as gold or silver.
2. The thickness of heavy specification deposits such as nickel.
3. The composition of solutions both as to basic components as well as brightener or other addition agents, thereby reducing the frequency of chemical analyses.

H. CLAY BRUBAKER, *Secretary.*

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LOS ANGELES BRANCH

The new management of the Cabrillo Hotel moved our quarters to the Ballroom on the fifth floor and raised the price of the dinner plate to $1.80 per plate, tip extra. Although the letter announcing the September 9th meeting failed to state where the meeting was to be held, the attendance was exceptionally large and for five or six latecomers there was standing room only. Approximately seventy-five attended, including sixteen guests.

The dinner included a more adequate serving of meat and as a result no complaints were heard from the standpoint of price as previously.

The first paper of the evening was delivered by Messrs. KARL RAIFE, Superintendent, Refrigerator Cabinet Division, and GLENN FULTON, Porcelain Enameling Superintendent, both of Norris Stamping and Manufacturing Company of Los Angeles. Their paper was entitled "Modern Porcelain Enameling". It was followed by a color film dealing with "The Making of Frit" and obtained through the courtesy of the O. Hommel Company, with dialogue by KARL RAIFE which tied in very nicely. There was a lively discussion, particularly with reference to the function of the "nickel dip" which follows the pickling of metal prior to porcelain enameling. It was disclosed that in the porcelain enameling industry some advocate the use of the "nickel dip" while others are against it.

The second paper entitled "Indium as a Brightener in Silver Solutions" by WALTER R. BEESLEY, Foreman Plater, Wallington Plating Works, Vancouver, B. C., and a member of this Branch, was read by Librarian GILBERT EXTALE.

JACK M. RASKIN disclosed that the function of the "nickel dip" is being investigated. In connection with Beesley's paper he stated that the co-deposition of Indium with precious metals was not new and had been the subject of several technical papers. Raskin agreed to provide the Secretary with a bibliography to pass on to Mr. Beesley.

Three new members were initiated and one was transferred in from the Cincinnati Branch.

Two educational courses for platers were announced, one at Poly High Evening School, instructor MR. SMITH, and another by U. C. L. A. Extension, instructor M. RASKIN. The Branch voted to circulate the members with a letter announcing these two courses. PRESIDENT ELDRED appointed himself a committee of one to investigate the course at Poly High School and provide the Secretary with the necessary data for inclusion in the announcement. It was stated that this is the third or fourth year that Poly High School has offered to accommodate those platers who are anxious to study plating chemistry. It is the first offer by the University of California at Los Angeles to accommodate our platers.

The passing of BOB GRIPP, first President of the Los Angeles Branch, and MRS. SUNDERHAUS, wife of Past-President JOE SUNDERHAUS, was announced.

The members were glad to shake hands again with C. C. MCLAREN who attended his first meeting since his serious plating room accident several months ago.

E. R. HOLMAN, *Secretary-Treasurer.*

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COLUMBUS BRANCH

The September meeting of the Columbus Branch was held on September 6 at the

home of Branch President E. L. COMBS. Eighteen members were present.

The election of JOHN G. BEACH as the new Secretary-Treasurer to succeed DAVID S. STOKER, resigned, was announced, and Mr. Beach assumed office during the meeting. The financial report for the past year was presented by PRESIDENT COMBS. A round-table discussion was next on the program. Various problems of the Branch and of the Society were discussed. The meeting ended with a social session complete with refreshments and poker.

The October meeting of the Branch is planned as a dinner meeting with wives and sweethearts of the members invited. The entire meeting will be devoted to social activities.

CLOYD A. SNAVELY,
Second Vice-President.

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ROCHESTER BRANCH

The Rochester Branch held a clambake September 21 at Westminster Park for members of the Buffalo and Rochester Branches.

The Buffalo delegation trimmed Rochester at softball and is still the proud possessor of the trophy.

Music was provided for round and square dancing by Bill Kern's Orchestra. Some of our, here unnamed, members sang and entertained us. JOHNNY ADAMS, Party Chairman, was the Master of Ceremonies and RAY BERGHOLD awarded the prizes. Others on the committee were CECIL THORNTON, ED HOLLISTER, DON BLUM and BOB FLINT.

Much credit is due the Buffalo Branch for excellent representation and jolly good fellowship. A grand time was had by all.

ROBERT L. FLINT, *Secretary.*

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SOUTHEASTERN BRANCH

The regular monthly meeting at the Robert Fulton Hotel Thursday evening, September 12, was attended by sixteen members, R. E. NORMAN presiding.

It was decided that the November meeting would be held in Birmingham; this had been planned for October but was not convenient for all concerned.

Four applications for membership were submitted and approved.

Our speaker for the evening, A. E. S. Past-President MR. FREDERICK FULFORTH of United Chromium, Incorporated, welcomed the Southeastern Branch to the Society stating that by cooperation and good fellowship our growth is assured. He then gave a very interesting talk on the part played by the plating industry during the war. He discussed in particular silver plating of aircraft bearings, plating on aluminum and heavy gold plating on parts for radar equipment. Mr. Fulforth answered all questions and received a standing invitation to visit us often at his convenience.

WM. T. WEYMOUTH,
Secretary-Treasurer.

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CLEVELAND BRANCH

The regular monthly meeting on September 6, at the Cleveland Hotel, was opened by President DR. RALPH SCHAEFER, who turned it over to Librarian ED FRIEDL. He, in turn, introduced MR. KENNETH TATOR, President of Industrial Lining Engineers, of Edgeworth, Pa., who gave a very comprehensive talk on the newer rubbers and plastics as aids in electroplating. At the end of the interesting presentation, there were numerous questions and some discussion.

Eight applicants were elected to membership. There was one in-transfer.

PRESIDENT SCHAEFER explained that at the meeting of the Executive Board on June 25 the duties of the officers were decided as follows:

The First Vice-President is the Chairman of the local Research Committee which will support the sutaining membership campaign and transmit to A. E. S. Research Committee suggestions for worthwhile projects for future work. He will also function as alternate to the Cleveland Technical Societies Council.

The Second Vice-President is to be the Chairman of the Social Functions Committee.

The Librarian will be the member on the

Cleveland Technical Societies Council's Program Coordination Committee, take care of the meeting notices in the Cleveland *Engineering*, and, wherever possible, in addition to contributing to the "events column" will provide a short resume on the speaker.

The Secretary will send a letter of introduction to each new member immediately upon his election.

The President is the active representative on the Cleveland Technical Societies Council.

This set-up was approved by the Branch which, in addition, also suggested that the Librarian head a Committee for Publicity.

STEVE MILLER gave a nice talk about our winning the membership prize last year. TOM GILL suggested a printed invitation card be sent to prospective members.

It was with deep sorrow that we heard of the sudden deaths of MRS. AUGUST HOFFMAN and a young daughter of CARL HEIL, brother of HARVEY HEIL. We wish to extend deepest sympathy to the families in their bereavement.

ERNEST V. COLLINS, *Secretary.*

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SYDNEY BRANCH

The twenty-ninth regular meeting was held at the Chamber of Manufacturers, Sydney, on Tuesday, 10th September.

Among the correspondence was a letter from MR. S. HERRICK, an Honorary Member of the Los Angeles Branch, who asked us to try and trace his brother who came to Australia forty-eight years ago. I am pleased to report that the Branch officers have found him and Mr. Herrick should hear from him in the near future.

One applicant was elected to membership and welcomed to the Branch.

A short talk on the impurities found in plating solution was given by one of the youngest members of the Branch, MR. W. MILLWARD of the Australian General Electric Proprietary, Ltd. Mr. Millward, who was a prisoner of war in Burma for four years, received well-deserved applause for his most interesting talk.

The Vice-President, MR. E. J. WRIGHT, conducted the meeting.

J. R. GODFREY, *Secretary.*

MILWAUKEE BRANCH

September 13 found the members of the Milwaukee Branch in Racine. The members there had taken it upon themselves to put on an impressive meeting in honor of two long-time members from Racine. They were RAY GOODSELL, former A. E. S. President and for many years an active member of the Milwaukee Branch, and HENRY BINDER, probably the only man to have held office in two Branches, Milwaukee and Chicago.

Each man was given a token of appreciation from the Branch for his activity and interest in all Branch affairs. We regret that Ray Goodsell could not be on hand and hope that he will soon be up and around again. A letter has been received from him thanking the members and saying that he would see them in not too distant a future.

The turnout at the affair was beyond expectations; over 100 members from far and near came and had a grand time.

The informative speech by DR. R. B. SALTONSTALL of the Udylite Corporation on "Plating Room Maintenance" was followed by enjoyable entertainment and a buffet lunch.

The credit for the overwhelming success goes to MR. RODNEY OLSEN of the Shepard Plating Company and the other Racine members. Thanks are given to the Racine companies who contributed to the financing of the affair.

JAMES DURNFORD,
Secretary-Treasurer.

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CHICAGO BRANCH

The September meeting, held at the Atlantic Hotel as usual, had excellent attendance with the Supreme Society represented by President FRANK SAVAGE and First Vice-President K. M. HUSTON.

MR. JOHN KREML, Research Chemist of the Rustless Iron and Steel Division of the American Rolling Mill Company, read a paper on "Electrolytic Polishing of Stainless Steels." He touched on the historical background of this operation and commented that its initial purpose in 1925 was to prepare samples for microscopic study

without distortion of the surface due to mechanical working. In addition, the anodic treatment assures an accurate presentation of the crystalline structures.

Rustless Iron and Steel installed two large commercial plants in 1938 for processing wire goods made from stainless steel. Although any metal may be processed by electrolytic polishing, this still remains the most important application. The main advantage in using this method for finishing wire goods is that it eliminates many handling difficulties that would be encountered in the usual polishing and buffing. Also, electropolishing never contaminates the surface with foreign materials as is possible with mechanical polishing and buffing methods.

Mr. Kreml touched on various unusual applications for the process. One is to reduce oversize pieces to the required size; since this attack is uniform, all high points or oversize areas were said to be removed simultaneously. Another is as an inspection method for castings; defective areas repaired by welding show very clearly. It also is an excellent method to insure adhesion of plated deposits to the basis metal. While different solutions are used for different base metals, all of them remove the weak Beilby layer which may interfere with good adhesion.

The company is interested in obtaining job shop licencees in many parts of the country because many small manufacturers of stainless steel products do not have enough production in their own plants to keep an installation busy. Arrangements with reputable plating shops that have equipment and ability to carry out this operation are desired.

A very interesting feature of this talk was the finale for which Mr. Kreml had set up a laboratory size installation in which he processed several parts submitted by members.

Both Mr. Kreml and Mr. Huston answered numerous questions from the floor indicating the great interest in this process which is well beyond the experimental stage.

G. Stuart Krentel,
Review Correspondent.

SAN FRANCISCO BRANCH

The September meeting was held on the 12th at the St. Julien Cafe in San Francisco.

The recent death of Mr. E. F. Dingley was reported. Mr. Dingley transferred to the San Francisco Branch from the Milwaukee Branch and has been active in the plating industry in this area for the past twenty years. He was well known to all members and it was with regret that the sad news was received.

One applicant for membership was elected.

A report was delivered by the Chairman of the Entertainment Committee on the proposed dinner party for members and their families. It was decided to arrange for reservations at a night club. Mr. A. Baker volunteered to contact the Bal Tabarin for reservations for December 11 or 13.

Mr. Elburn Marcum, West Coast Technical Director of the du Pont Company, delivered a very interesting and instructive talk on du Pont Hi-Speed Copper. There followed considerable discussion, and many questions were ably answered by Mr. Marcum.

Thirty members and two guests attended.

Fred W. Huntington,
Secretary-Treasurer.

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PITTSBURGH BRANCH

The first meeting of the 1946–47 season was held in the Avalon Room of the Keystone Hotel on Thursday evening, September 19. As usual, it was preceded by a dinner, at which twenty-five members and guests were present.

President F. R. Keller presided over a short business meeting when it was decided to hold the remaining meetings at the same location. Librarian Hennessy reported on the activities of the Educational Committee and gave a list of very able speakers which it has lined up for most of the remaining meetings of this year. The names of eleven applicants for membership, which had accumulated over the summer, were read and referred to the Board of Managers. S. S. Johnston told of attending a meeting of the Research Committee, and was very

enthusiastic in his report of its activities. After some discussion, Mr. Hennessy's motion that a sum equal to $2.00 per Branch member be donated to the Research Fund from the Branch treasury, was unanimously carried.

The first of a series of short talks on the general subject, "Fundamental Principles Underlying Electroplating," was then given by MR. R. A. DIMON. The subject of this talk was "Faraday's Law".

Mr. Hennessy then introduced the principal speaker of the evening, DR. WILLARD W. HODGE, Senior Fellow at Mellon Institute for the National Council of Stream Purification. He spoke on the very timely subject, "Disposal of Waste Pickle and Plating Room Solutions". Dr. Hodge first covered Federal and State Laws bearing on his subject and followed with some suggested methods of treating waste liquors to render them harmless. His talk was followed by a very lively discussion, during which he answered numerous questions.

A display of some examples of job plating work was provided by the Cowan Manufacturing Company, of Pittsburgh.

RICHARD A. DIMON,
Secretary-Treasurer.

●

MONTREAL BRANCH

The Annual Banquet on Friday, September 13 at the Mount Royal Hotel had an attendance of forty-five members and guests. The excellent meal was followed by a hearty sing-song led by WILLIAM GLOVER who then introduced MR. T. A. WILLIS who favored us with a brace of fine solos.

MR. J. T. REISENBERG then introduced the first speaker of the evening, MR. L. S. WILLIAMS of Canadian Hanson-Van Winkle Company who gave an illuminating talk on "Bright Alloy Plating" accompanied by a film to illustrate the salient points of the lecture.

Our second speaker, MR. J. E. TERMUENDE of the Aluminum Company of Canada, then discussed "The Use of Aluminum as a Conductor in the Plating Room", a subject of interest to all.

President G. R. DAVIDSON and the Banquet Committee are to be congratulated on having obtained two very fine speakers and the very efficient manner in which the banquet was conducted.

WM. GLOVER, *Secretary-Treasurer.*

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NEWARK BRANCH

The regular meeting of the Newark Branch, A. E. S., was held on Friday evening, September 6, 1946, at the Hotel Robert Treat in Newark, N. J. The meeting was called to order by PRESIDENT DE VRIES at 8:30 P. M. Other officers present were First Vice-President HOWARD L. COBB, and Second Vice-President WILLIAM HODECKER, JR.

During the summer months, seven applications for membership were received. There were six elections to membership, two in-transfers and two out-transfers. Four resignations were accepted.

The President appointed Second Vice-President WILLIAM HODECKER, JR., as Chairman of Newark Branch's Membership Committee.

PRESIDENT DE VRIES ordered a minute's silence in honor of our departed member, JOSEPH FUSCO.

The President then turned the meeting over to MR. HOWARD COBB, pinch-hitting for LIBRARIAN IRENAS who was ill. Mr. Cobb called on MR. EDWARD BOWERMAN and MR. JOHN GUTHRIE to report on Convention papers.

Considerable discussion on the papers was in order and the speakers asked numerous questions.

GEORGE REUTER,
Secretary Pro-tem.

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NEWARK BRANCH

The regular meeting of the Newark Branch, A. E. S., was held on September 20, 1946, at the Hotel Robert Treat in Newark, N. J. The meeting was called to order at 8:30 P. M. with forty-six members present, President JOHN DE VRIES presiding. Other officers present were: First Vice-President HOWARD L. COBB; Librarian ZACHARY IRENAS, and Sergeant-at-Arms ROBERT S. HERWIG.

The minutes of the previous meeting were read and approved.

Communications were read from Executive Secretary KENNETH GRAHAM; GORDON HODGE, Secretary of the Technical Societies Council; ARTHUR LOGOZZO of Detroit Branch. PRESIDENT DE VRIES ordered that the letter from Detroit Branch be held over until the next meeting.

A card of thanks from the bereaved family of JOSEPH FUSCO, Secretary, Four Plating Company, Inc., was read.

One application was received and ordered to take the regular course, and one in-transfer was reported.

PRESIDENT DE VRIES asked for an opinion of the members on the new folder of the Technical Societies. The members seemed to think that it was better than the old one, but that there was still room for improvement.

LIBRARIAN IRENAS introduced the speaker of the evening, MR. PAUL OLDAM, Newark Branch, whose subject was "Gold Plating". Mr. Oldam spoke of the tolerance of gold solutions for various anion impurities, and the use of insoluble anodes. He also discussed coloring formulas for gold-plated work.

Numerous questions were asked and answered as only PAUL OLDAM can answer, as a man who knows his gold solutions. The speaker was given a rising vote of thanks.

GEORGE REUTER,
Secretary Pro-tem.

●

BUFFALO BRANCH

The Buffalo Branch of the American Electroplaters' Society got off to a good start Friday evening, September 13, 1946, with thirty members present.

Vice-President C. J. WERNLUND presided. JOE RUFF acted as temporary Secretary in the absence of JOHN KUSHNER.

C. J. WERNLUND started a lively discussion in proposing a class to be formed for instructions in plating solutions. The meeting was very much in favor of such a class. It was voted that cards be sent out to members for a specific answer. The only stipulation appeared to be that it should be held where members could smoke.

Plans were made to attend the Rochester Branch picnic, and above all to lay the groundwork for the winning of the celebrated baseball classic or havoc between Buffalo and Rochester. We did this without even a rumor that the Buffalo Bisons might have assisted.

C. LOGAN'S report of the Pittsburgh Convention was complete and with a few embellishments, such as Campbell's soup being served at the Heinz Plant. Knowing conventions as we do, we can well appreciate this possibility.

We learned with regret that Montreal will be unable to be the Convention Hosts for 1947. It must be disappointing after such good work. If not 1947, here's to 1948.

The Sick Committee advised that STANLEY SHARMEN was now recovering at home after a sojourn in the hospital, and we all wish a speedy recovery for Red.

It was good to see CHRIS WERNLUND in the chair, although not able to talk quite as fully as usual. His left arm is still not fully limbered from the effects of an automobile accident and has to talk with only one hand.

The meeting was closed with all feeling that a very active and full year lies ahead.

W. M. FOTHERINGHAM,
Review Correspondent.

●

PHILADELPHIA BRANCH

After having a very good dinner a the Broadwood Hotel, PRESIDENT ORLIK called the September meeting to order about 8:30 P. M. with all officers present.

LIBRARIAN HIRSCH introduced the speaker of the evening, K. GUSTAF SODERBERG, Editor of THE MONTHLY REVIEW, formerly with the Udylite Corporation, whose subject was "Development of Cadmium Plating".

The speaker started with the discovery of cadmium in 1817 and traced the various patents issued beginning 1847 down through the years to the present; noting the world sources of supply through the high and low grade cadmium content zinc ores. He also stated the possible lowering of cadmium

production, unless new high content ore locations are found.

Mr. Soderberg answered the many questions quite promptly, and received a rising vote of thanks.

Nine applications for membership were referred to the Board of Managers. One candidate was elected to membership and one transfer was accepted. One suspension was reported.

PAUL MENTZER, SR., *Secretary.*

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NEW HAVEN BRANCH

The New Haven Branch of the American Electroplaters' Society opened its fall sessions on Sept. 10, 1946, with a dinner, served in the "Pilgrim Room" of the Hotel Duncan. The members then adjourned to the Sterling Laboratory, Yale University. Technical Chairman CLARENCE GARNER opened the business meeting and heard reports from the various committees.

MR. RALPH MCCAHAN of E. I. duPont de Nemours & Co., Inc., a popular visitor at our branch meetings, spoke to the members on "High Speed Copper". A noted authority on this bath, Mr. McCahan covered his subject completely and aroused much discussion during his question period, the main participants being DR. WALTER R. MEYERS and JOSEPH L. DOWNES.

A rising vote of thanks was given by the members for this excellent talk. Meeting adjourned at 10:30 P. M.

B. J. GAFFNEY,
Secretary-Treasurer.

●

CINCINNATI BRANCH

The Cincinnati Branch reported on October 6 that it had its first fall meeting devoted entirely to business matters. Sixty members were reported, according to the present membership list, and the following list of Officers:

President—AUGUST SCHWERING
Vice-President—EARL ROBBINS
Secretary-Treasurer—CHARLES NUZUM
Librarian—WILLIAM S. CHIPMAN
Board of Managers—JOHN DAYMUDE, WILLIAM EHLEN, WILLIAM B. STODDARD, JR., and H. E. NICE

ST. JOSEPH VALLEY BRANCH

The regular monthly meeting of the St. Joseph Valley Branch was held in the Empire Room of the Hotel Elkhart at Elkhart, Ind., September 4. Dinner was attended by 39 members and guests. There was an attendance of 48 at the business meeting which followed the dinner.

The meeting was opened by K. HARLAN, the Vice-President, who introduced J. LOCKERBIE, the retiring President, and asked him to install the new officers for the coming year. Mr. Lockerbie installed the following officers:

President—K. HARLAN
First Vice-President—C. MCDOWELL
Second Vice-President—J. HEDGES
Secretary-Treasurer—R. FRIEND
Librarian—H. WIESNER
Board of Managers—V. PETERSON, T. SHAFER, F. ROBINSON

One application for membership was received.

The Membership Chairman, C. MCDOWELL, appointed the following to the Membership Committee: M. BEREMAND, P. MOORE and J. CUSHING.

The meeting was turned over to Mr. Wiesner who gave the list of speakers for the coming year and then introduced the speakers for the evening, T. ROSS LYONS of the Hanson-Van Winkle-Munning Company and R. C. SCOTT of The Udylite Corporation, who led a round table discussion of rectifiers and generators. At the conclusion of the discussion the meeting was turned back to the President.

There being no further business the meeting was adjourned.

R. A. FRIEND, *Secretary-Treasurer.*

●

DETROIT BRANCH

The October meeting of the Detroit Branch of the American Electroplaters Society came to order at 8:00 P. M. Friday, October 4, at the Hotel Statler.

Approximately 200 members and guests were present to enjoy a very interesting and instructive talk and demonstration entitled, "Electropolishing of Stainless Steel in the Citro-Sulfuric Acid Solution". This wa delivered by JOHN KREML of the America

Rolling Mill Company, assisted by KENNETH HUSTON, First Vice-President of the Supreme Society. Following the talk and demonstration Messrs. Kreml and Huston electropolished a number of stainless steel samples brought in by members to determine the results of the process on their particular articles.

Our motion picture for the evening was entitled, "Dateline Tomorrow", courtesy Aluminum Company of America, and it proved very interesting, inasmuch as it pointed out the various finishes which might be obtained on aluminum using mechanical, chemical, electrochemical, electroplated, and organic coating methods.

GEORGE HOGABOOM and THOMAS FLATTERLY, Assistant Director, Bureau of Engraving, honored the meeting by their presence. We were pleased to see them and wish to extend again the cordial invitation to all to attend our meetings whenever possible.

MR. PILLSBURY pointed out that based on the talk and picture of the evening it was apparent that the platers of the country would have work to do for some time to come since the finishing of both stainless steel and aluminum required plating or similar equipment.

GEORGE NANKERVIS gave us a short progress report on the plans for the annual party to be held December 14, and also spoke briefly of the plans for the Convention to be held in Detroit next June.

A large number of new members were elected and presented indicating that the Detroit Branch is making a strong effort to keep its membership up in first place.

Eugene F. Dingley

It was with deep regret that news of the death of E. F. DINGLEY, well-known member of the plating industry, on August 19, 1946, was received.

Mr. Dingley had been active in the plating industry in the San Francisco area for the last thirty eight years, both as a shop owner and as a consultant and solution analyst.

For fifteen years he was a member of the American Electroplaters' Society and the Electroplaters' Association. He was also a member of the Oakland Lodge of Masons, Scottish Rite Bodies, Ashmes Temple of the Shrine, Woodmen of the World, Oakland Chamber of Commerce, and California Metal Trades Association.

Recent Contributor Dies

WILLIAM H. ADAMS, JR., a graduate of M.I.T., died on June 28 of this year at the age of 43 in the Memorial Hospital in Wilmington, Delaware. He came to the HAVEG CORPORATION at the time of its formation in 1932, and served as Technical Director until he passed away. Prior to this he had served with the parent company, the Continental-Diamond Fibre Co., from 1925 on.

P. L. MCWHORTER, JR., who succeeds Mr. Adams, joined the organization in March, 1941, as a Sales Engineer and represented it in the New England territory until February, 1945, at which time he was appointed acting Technical Director while Mr. Adams took a seven-month leave of absence for reasons of his health. Following Mr. Adams' death, Mr. McWhorter, on July 24, was permanently appointed to the position of Technical Director, and in addition, more recently was named Manager of all Haveg operations.

●

N.A.C.E. TO HOLD CONVENTION

The *National Association of Corrosion Engineers* will hold its Annual Convention in the Palmer House, Chicago, Ill., on April 7th, 8th, 9th, and 10th, 1947.

There will be symposiums on the following industries: Water, Electrical, Chemical Communications, Gas, Oil, Cathodic Protection, and General. In addition to the technical sessions, N. A. C. E. is sponsoring 100 exhibits on corrosion-inhibiting products and supplies.

Information concerning the Convention can be obtained from *Elton Sterrett*, Executive Secretary of the National Association of Corrosion Engineers, 905 Southern Standard Building, Houston 2, Texas.

HERE IS PLATING POWER THAT WON'T "TIE YOU DOWN"!

Suppose your work-load changes and you need a different range of d-c voltages, or increased current at low voltage. Will your present d-c source "tie you down," requiring replacement to meet the new conditions?

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(Above) Bank of G-E "500" Rectifiers, showing compact multiple-unit arrangement.

GENERAL ELECTRIC

By DR. HAROLD J. READ
Associate Professor of Metallurgy
The Pennsylvania State College

JOURNAL OF THE ELECTRODEPOSITORS' TECHNICAL SOCIETY, Volume XX, 1944–45. Edited by S. Wernick and S. W. Baier. Electrodepositors' Technical Society, Northampton Polytechnic Institute, St. John Street, Clerkenwell, London, E.C.1. Price, One Guinea.

Inasmuch as the Electrodepositors' Technical Society is the British counterpart of the American Electroplaters' Society, members of the latter will undoubtedly find considerable interest in the papers presented before the British Society. The volume under review contains 15 papers which were read during the 1944–45 meetings in London and Birmingham. A resume of the discussions of nine of the papers is included in the volume and contributes much to the value of the book.

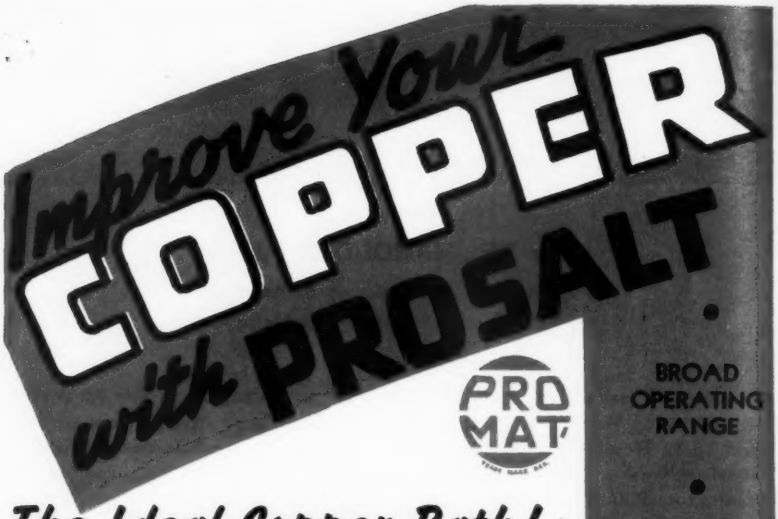
A wide variety of subjects is treated by the various authors. As far as the plating operation itself is concerned, there are papers relating to the lead plating on bearings, the electroplating on wire, silver deposition on steel, copper powder manufacture by electrodeposition, machinable chromium deposits, the influence of anodes on the plating process, and the use of chloronaphthalene wax as a stop-off material. Considerable attention is given to plant operation in most of these papers, and the American reader will have a good oportunity to see how some things are done rather differently abroad.

Control of deposits is the subject of two papers, one on electrography as applied to the examination of electrodeposits, the other on a simple magnetic tester for determining the thickness of coatings on a steel base (a sort of overgrown Magne-Gage with a lever weighing system). The paper on electrography is particularly interesting and deserves the attention of everyone concerned with the examination and analysis of metallic surfaces and finishes. Very little new material is presented, but the author ably summarizes much of the work which has been described in the literature.

Other miscellaneous papers deal with the protective value of tin as an undercoating, black finishes on steel (a review paper), the relationship between the drawing of metals and the production of good electrodeposits, chromate passivation of zinc, and the effect of sulfate in an anodizing solution.

The prospective reader is warned not to expect that every article is a report of recent research work—in fact, one paper is based on work carried out twelve years ago. But like certain beverages, the quality and desirability of the information is not lessened by its age.

The reluctance of the British to use high current densities is reflected throughout the book and is particularly evident when the paper devoted to silver plating on steel is contrasted with Mesle's recent contribution in the MONTHLY REVIEW. The same point comes up in connection with the paper on wire plating. An ingenious but exceedingly complicated apparatus is used to keep the wire in the nickel bath as much as 20 minutes simply because 60 amperes per square foot is regarded as maximum current density.



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PROSALT has all of the advantages of the Rochelle bath. Existing Rochelle baths may be converted by the addition of 130 cc. Prosalt per gal.

Make-Up Analysis Prosalt Copper Bath	Cost
Copper cyanide, 3.5 ounces per gallon	$0.0764
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Sodium carbonate, 4.0 ounces per gallon	0.0075
PROSALT, 130 cc. per gallon	0.184
	$0.3169 per gallon

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By GEORGE B. HOGABOOM

Consultant, New Britian, Conn.

No. 2,405,302, August 6, 1946—Composition for and Method of Purifying Electrolytes—D. L. Griffith and L. G. Hendrickson, assignors to Hudson Bay Mining & Smelting Co.

CLAIM 2. In the purification of zinc electrolytes by means of metallic precipitants, the step of contacting the electrolyte with zinc dust coated with copper and indium as the precipitant.

No. 2,405,366, August 6, 1946—Manufacture of Zinc Borate—A. J. Myhren and E. W. Nelson, assignors to The New Jersey Zinc Co.

The process for producing zinc borate of the composition $2ZnO.3B_2O_3.7H_2O$ which comprises mixing borax and zinc sulphate in solution and precipitating zinc borate in the presence of sufficient additional zinc compound from the group consisting of zinc oxide and zinc hydroxide to provide a ratio of zinc to borax of 1:3.

No. 2,406,072, August 20, 1946—Electrodeposition of Metal and Bath Composition Therefor—Kenneth M. Gaver, assignor to Ohio State University Research Foundation

My invention is particularly adapted to nickel plating, but, in its broadest aspects, is applicable as an improved plating bath for producing a smooth, uniform plate in electrodepositng other metals such as chromium, copper, zinc, cadmium, cobalt and iron.

My improved addition agent is produced by reacting starch with alcohol soluble hydroxides such as sodium, potassium and the like under conditions such that metallic starch alcoholate is produced. The particular starchate compound may be selected to correspond to the metal salt which is in solution in the bath for supplying the metal to be deposited.

EXAMPLE I

	Parts by Weight
Nickel Sulfate	135–165
Nickel Chloride	20–30
Boric Acid	20–40
Sodium Starchate	5–25

EXAMPLE II

Nickel Sulfate	135–165
Nickel Chloride	20–30
Boric Acid	20–40
Nickel Starchate	5–25

EXAMPLE III

Sodium Cyanide	100–125
Cadmium Hydroxide	35–50
Sodium Sulfate	40–55
Sodium Starchate (dry)	10–25

EXAMPLE IV

Copper Cyanide	100–120
Sodium Cyanide	150–160
Sodium Carbonate	25–30
Sodium Starchate	5–20
(50% aqueous solution)	

CLAIM 2. A plating bath for the electrodeposition of metal comprising an aqueous solution providing ions of the metal to be deposited and having a colloidal solution of a starchate compound comprising the reaction production of starch and an alkali metal incorporated in the bath.

CLAIM 15. A plating bath comprising nickel sulphate, nickel chloride, boric acid, nickel starchate, and water in quantity sufficient to provide a bath of the desired concentration.

No. 2,406,683, August 27, 1946—Electroplated Drift Free Spring—F. R. Hensel, Earle I. Larsen and A. M. Suggs, assignors to P. R. Mallory & Co., Inc.

We have discovered that electroplating springs introduces undesired stresses in the springs which accelerate their drift characteristics. The present invention contemplates a process of making electroplated springs free of plating stresses. According to the present invention, the springs are subjected to a process step after plating which relieves such plating stresses. This comprises a low temperature annealing step. This may be applied immediately after plating, or the plating may be done at a semi-finished stage followed by subsequent rolling or other cold reduction operations and the annealing step applied after such operations have been performed.

The electroplated coatings may be applied by conventional electroplating processes for plating pure metals or alloys. Electroplates which may be applied are nickel, zinc, cadmium, tin, the precious metals such as silver, palladium, platinum, rhodium and gold, and alloys such as silver-thallium, silver-lead, gold-thallium and gold-lead. Chromium may also be used as the electro plated coating, but in this case it is only applicable where the coating is applied after all mechanical working or reduction operations have been performed.

CLAIM 1. The method of making a corrosion resistant spring having low drift characteristics which comprises electroplating a layer of corrosion resistant material upon a spring metal body composed of copper-beryllium alloy, said plating accelerating the drift characteristics of said spring metal body, and annealing at a temperature within the range of about 100° C to about 350° C but below the recrystallization temperature of copper-beryllium spring alloy for a period of about 10 minutes to 4 hours thereby to eliminate the accelerated drift characteristics of the spring metal.

No. 2,407,145, September 3, 1946—Method of Handling Small Articles in Electrolytic Treatment—C. T. Elwin, assignor to Scovill Manufacturing Company.

It is one of the objects of this invention to provide a method in which small articles may be mounted on a support or rack in a pre-arranged manner and so held for any subsequent treatment to which the articles may be submitted. The method contemplated is for the treatment of small articles wherein there will be no objection to having a relatively small portion or surface of the article not subjected to the treatment to which the major part or surfaces of said articles are to be subjected.

CLAIM 3. The method of affixing small metallic articles of like uniform character for electrolytic treatment which comprises applying an adhesive material of a frangible character when in a dry state to one side of a portable electric conductor member the surface of which comprises numerous closely spaced projections subdivided by corresponding recesses, applying the articles to the adherent side of said member in a pre-arranged uniform manner and spaced relative to each other while the material is in a tacky state, applying sufficient pressure to the articles to squeeze out the adhesive between said articles and the member and assure a metal-to-metal contact between a portion of said articles and the apexes of the interposed projections, retaining said articles in a set position until the adhesive material has dried, then subjecting the combined member and articles to a electrolytic treatment and finally breaking the treated articles away from said member as individual units.

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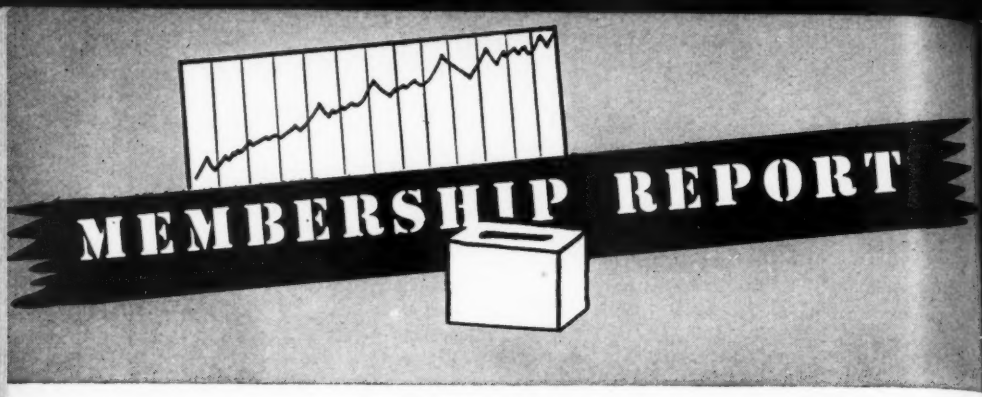

S. S. JOHNSTON

Chairman, Membership Committee

ELECTIONS

BRIDGEPORT BRANCH

William R. Porter, Jr., 80 Regent Terrace, Devon, Conn.

F. Rolf Morral, American Cyanamid Co., 1937 W. Main St., Stamford, Conn.

LeRoy P. London, 129 Richmond Ave., Amityville, N. Y.

CLEVELAND BRANCH

Daniel Gurovich, Jr., 4689 E. 85th St., Cleveland 5, Ohio

Thomas E. Morrow, c/o Canton Plating Co., 1319 Fifth St., N. E., Canton, Ohio

Emil Pavlik, 5005 Montauk Ave., Parma 9, Ohio

M. S. Roush, 23555 Euclid Ave., Cleveland 17, Ohio

D. Dale Stiteler, c/o Canton Plating Co., 1319 Fifth St., N. E., Canton, Ohio

Arthur D. Swindell, R. D. No. 3, Alliance, Ohio

Albert F. Vinal, National Carbon Co., P. O. Box 6087, Cleveland, Ohio

H. Meredith Zimmerman, National Carbon Research Laboratories, P. O. Box 6087, Cleveland 1, Ohio

DAYTON BRANCH

Richard M. Clinehens, 70 Victor Ave., Dayton, Ohio

Charles N. Chalfant, 1428 San Rae, Apt. K, Dayton 9, Ohio

DETROIT BRANCH

Ross W. Buchanan, AC Spark Plug Div., General Motors Corp., Flint, Mich.

Richard T. Connors, 1651 E. Grand Blvd., Detroit, Mich.

L. D. Creegar, Budd Wheel Company, 12141 Charlevoix, Detroit 14, Mich.

William N. Dunlap, 12338 Northlawn, Detroit 4, Mich.

George R. Edgington, 1692 Birwood, Detroit 21, Mich.

Russell C. Fancher, 1140 Withoin Ave., Detroit 5, Mich.

Thomas DeGaetano, 3904 Meldrum, Detroit 7, Mich.

Arthur W. Grant, Electro-forming Dept. E-7, R. S. Rubber Co., Detroit, Mich.

Emery A. Guertin, 3931 Brush St., Detroit 1, Mich.

Kenneth W. Lenton, A.M.I.A.E., 33 Orchard Crescent, Coventry, England.

Bruno Leonelli, 238 Rhode Island, Highland Park 3, Mich.

Clifford Menzies, 286 West Montana, Detroit 3, Mich.

William H. Mogle, Anotreat, Inc., 310 S. East Avenue, Jackson, Mich.

Wilfred H. Moffatt, 1651 East Grand Blvd., Detroit 11, Mich.

Frank E. Smith, 43 Grove St., Leamington, Sta., England.

Lawrence J. Stockwell, 11117 Worden Ave., Detroit 24, Mich.
Charles E. Tackels, Jr., 555 W. Breckenridge, Ferndale 20, Mich.
Howard J. Ward, 1311 Hollywood Blvd., Grosse Pointe Woods, Mich.

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Charles O. Harkin, Metal Coatings and Manufacturing Co., Elwood, Ind.
William G. Niehaus, 937 N. Capitol Ave., Indianapolis, Ind.
Claude B. Smith, 1716 Keller, Columbus, Ind.

JACKSON-LANSING BRANCH
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Gustav Oetterman, 5929 Franklin Ave., Los Angeles 28, Calif.
Mitchell Raskin, 3511 Stocker, Los Angeles 43, Calif.

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Gaston Paquet, 7 D'Argenson St., Quebec City, Quebec, Canada

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Michael P. Trifoglio, 26 Grand St., Weehawken, N. J.
Charles J. Perry, 59 Bruen Ave., Irvington 11, N. J.

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James J. Vincent, P. O. Box 272, Oyster Bay, N. Y.

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Ivan V. Hood, 215 Comstock Ave., Syracuse 10, N. Y.

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T. V. Morrison, 699 Hague Ave., St. Paul, Minn.

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Harold H. Santelben, 45 Harslett Crescent, Kogarah, N. S. W., Australia
Leslie A. Storey, Aerial Radio Service, 83C Condamine St., Balgowlah, N. S. W., Australia
Anthony J. Walton, 225 Pacific Highway, Artarmon, N. S. W., Australia
Elliott G. Williams, 4 Margaret St., Ashfield, N.S.W., Australia

TRANSFERS

Ralph M. Sasso from Bridgeport Branch to New Haven Branch
C. Hohner from Detroit Branch to Southeastern Branch
M. H. Orbaugh from Detroit Branch to Los Angeles Branch
J. Pearsall from Detroit Branch to Cleveland Branch
J. D. Kershaw from Detroit Branch to Grand Rapids Branch
Robert H. Tiers from Hartford Branch to Philadelphia Branch
Carl M. Cartledge from New York Branch to Southeastern Branch
Helmer Bengston from Pittsburgh Branch to Dayton Branch

RESIGNATIONS

BRIDGEPORT BRANCH
Lester Toohill, Jr.

CLEVELAND BRANCH
Tully S. Hammer
Frank Hovorka
John J. Tyner

DAYTON BRANCH
Albert O. Fink

DETROIT BRANCH
Maxwell Wise
S. H. Alliton

LOS ANGELES BRANCH
E. P. Troeger
Cecil Wilson

MONTREAL BRANCH
Estelle Gravel

PHILADELPHIA BRANCH
W. M. Cole
J. P. Majeske
A. J. Monari

SYDNEY BRANCH
P. B. Hudson

SYRACUSE BRANCH
Merle L. Ihrie

TOLEDO BRANCH
B. C. Phillips

TORONTO BRANCH
Robert F. Wheeler

REINSTATEMENTS

DETROIT BRANCH
A. T. Dunn

SUSPENSIONS

BRIDGEPORT BRANCH
George H. Goddu
Alexander Weisker
Jacob Kaplan

DAYTON BRANCH
J. L. Richards

LOS ANGELES BRANCH
Leo Brame
Frank Sisto

PHILADELPHIA BRANCH
S. S. Kingsbury

SAN FRANCISCO BRANCH
Albert Bell
Leland Mocker
F. J. Herrmann
Manuel Souza

SYRACUSE BRANCH
Carlton H. Rinehart
George Skinner

DEATHS

NEWARK BRANCH
Joseph A. Fusco
Louis V. Taylor

ROCHESTER BRANCH
Martin Crean

SAN FRANCISCO BRANCH
E. F. Dingley

WATERBURY BRANCH
Charles A. Mosgrove

SILHOUETTES EXHIBITED

George B. Hogaboom, Sr., has sent us this clipping from the COURANT, Hartford, Conn., dated September 8:

"A group of silhouettes by Edward M. Stephenson of Oakland Terrace now on exhibition in the art and music room of Hartford Public Library includes many new items added by the artist since his last silhouette display four years ago.

"Among the 25 pictures, the largest of which measure 12 by 20 inches, are a variety of animal and woodland scenes. Although the artist has occasionally used silver and gold as backgrounds, the three-dimensional effect which characterizes much of his work is achieved in black and white.

"Mr. Stephenson, a 77-year-old Yorkshire man who came to this country in 1882, has been cutting silhouettes since he was eight and considers the occupation the perfect relaxation for leisure hours."

He is also an Honorary Member of the Hartford Branch.

MEMBERSHIP REPORT

BRANCH	May 1946	Change in Membership	Percent Change
FIRST GROUP			
NEW YORK	201	+18½	+ 9.2
BRIDGEPORT	124	+ 8½	+ 6.9
PHILADELPHIA	170	+11½	+ 6.8
CHICAGO	359	+12½	+ 3.5
HARTFORD	134	+ 3½	+ 2.6
CLEVELAND	177	+ 3½	+ 2.0
BOSTON	168	+ 2½	+ 1.5
LOS ANGELES	181	+ 1½	+ 0.8
TORONTO	131	+ 1	+ 0.8
WATERBURY	128	− ½	− 0.4
NEWARK	243	− 8	− 3.3
DETROIT	440	−37½	− 8.5
SECOND GROUP			
INDIANAPOLIS	90	+13	+14.4
PITTSBURGH	97	+ 8	+ 8.2
PROV.-ATTLEBORO	122	+ 7	+ 5.7
DAYTON	87	+ 3½	+ 4.0
BUFFALO	87	+ 1	+ 1.1
SPRINGFIELD	82	....	....
BALTIMORE-WASH.	114	....	....
GRAND RAPIDS	116	....	....
ST. LOUIS	122	....	....
ROCHESTER	197	− 1	− 1.0
SYDNEY	82	− 2	− 2.4
MILWAUKEE	120	− 3	− 2.5
NEW HAVEN	110	− 3	− 2.7
JACKSON-LANSING	85	−32½	−38.2
THIRD GROUP			
ADELAIDE	37	+12	+32.5
SAN FRANCISCO	64	+ 5	+ 7.8
SYRACUSE	64	+ 4	+ 6.3
ST. JOSEPH VALLEY	60	+ 3	+ 5.0
TWIN CITY	72	+ 3	+ 4.2
COLUMBUS	34	+ 1	+ 2.9
LANCASTER	38	+ 1	+ 2.6
MELBOURNE	59	+ 1	+ 1.7
ROCKFORD	53	....	....
TOLEDO	60	− ½	− 0.8
CINCINNATI	58	− ½	− 0.9
MONTREAL	61	− 4	− 6.6

Membership May 1, 1946:	4,527	Gain in Membership:	51
Membership October 15, 1946:	4,578	Percent Gain:	1.1

YOU AND YOUR FRIEND

This message is directed to you as an individual member of the American Electroplaters' Society for you are the one who can obtain new members for your Branch and your Society.

Do you have a friend who would benefit by membership in the A. E. S.?

By inducing him to join, you have helped him and you have added a new face, a new talent and new ideas to your local Branch.

What gains does your friend derive from becoming a member of our Society? You know the answer but, to refresh your memory, here are some of the advantages to be enjoyed:

1. He will meet informally at least once each month with a group of men, all interested in electroplating or its allied arts, to participate in educational sessions designed to increase the knowledge of those who attend.
2. He receives at no additional cost THE MONTHLY REVIEW which includes well-written articles by competent authors in the field.
3. He receives, free of charge, a copy of the *Proceedings of the Technical Sessions* at the Annual Meeting of the Society. This contains all the technical papers presented together with the complete discussions thereof. The price of this volume alone is $6.50 to non-members.

You probably can list other benefits from your own experiences, in addition to these.

Your friend and the American Electroplaters' Society will benefit if you get in touch with your Branch Secretary and obtain an application blank for him to fill out.

Don't delay—do it NOW.

S. S. JOHNSTON,
Membership Chairman.

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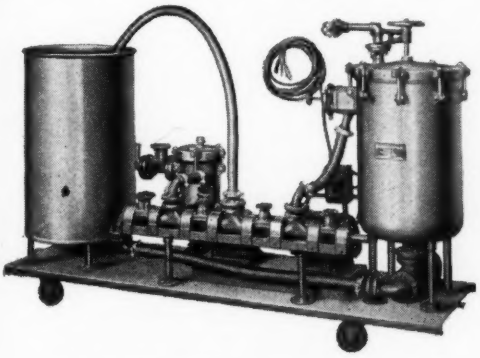
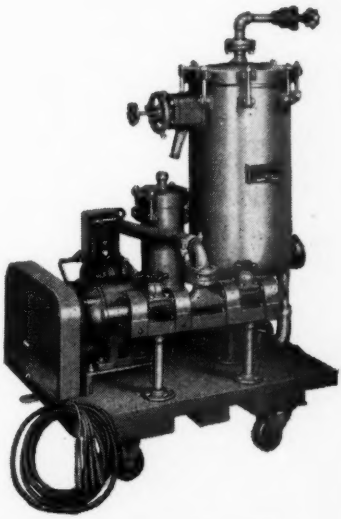
You can keep your plating plant operating at top efficiency only if you have adequate filtration. Industrial filter systems are designed and built to provide continuous high speed filtration and circulation.

Industrial Filters equipped with the AIRWASH cleaning feature have been in continuous use for months without opening the filters or removing the plates. Air agitation quickly dislodges the accumulated sludge and leaves the filter clean and ready for a new filter cycle. Many hours of production time are saved thus lowering your operating costs.



No. 1—Filter shown is equipped with slurry tank with double suction and discharge control providing an ideal continuous filtration system.



No. 2—A typical portable filter as constructed for bright nickel, acid copper and other acid type bath. Used for either intermittent or continuous filtration.

Other Products

Salt Fog Corrosion Test Equipment

Centrifugal Pumps of Duriron, Worthite, Stainless Steel, Hard Lead, Bronze and Iron.

In Stock

Filterbestos

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Filter Powder in all grades

Prompt shipment

INDUSTRIAL FILTER & PUMP MFG. CO.

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INDUSTRY NEWS

PLATING SUPPLY SALESMAN WANTED

Three good territories open in Ohio and New York State for capable, experienced men by old established company manufacturing Plating Equipment, Supplies and Buffing Compositions.

State experience, references and salary expected. Replies held in strict confidence. Our Staff knows of this Ad.

Address MR-11C, Monthly Review, P. O. Box 168, Jenkintown, Pa.

A. E. S. SEEKING RESEARCH ASSOCIATE FOR PROJECT

WANTED—A graduate in Chemistry or Metallurgy, with at least two years' experience or graduate study, preferably on electrodeposition, to work as a Research Associate of the American Electroplaters' Society, at the National Bureau of Standards, upon the physical properties of electrodeposited metals. Salary about $3,400 per year. Applicants should send full statement of their education and experience to Dr. William Blum, National Bureau of Standards, Washington, D. C.

GENERAL FOREMAN WANTED

POSITION OPEN with large company in Boston for general foreman of finishing operations (polishing, buffing, and electroplating). Excellent opportunity for qualified person. Compensation depending upon qualifications. Address inquiries to M. R.-11B, P. O. Box 168, Jenkintown, Pa.

POSITION WANTED

Electroplater: (Foreman) 20 years' experience all commercial finishes including polishing. Capable installing all equipment, control solutions, methods of production, etc. Age, 42; A. E. S. member. Send replies to MR-11D, MONTHLY REVIEW, P. O. Box 168, Jenkintown, Pa.

SITUATION WANTED

PLATING FOREMAN. Young man with thirteen years of practical and technical experience in plating and metal finishing. Can make up and control all solutions by chemical analysis. Consider job as trouble-shooter with an industrial chemical company. Send replies to M. R.-11A, MONTHLY REVIEW, Box 168, Jenkintown, Pa.

New Plating Course on West Coast

University of California, Los Angeles, has announced a new course which should be of interest to every West Coast member of the A.E.S. It will be a practical course for platers who wish to understand the fundamentals and advanced practices of electroplating.

SUBJECT: Science and Practice of Electroplating.

ADDRESS: 1027 Wilshire Boulevard (old Woodbury College).

REGISTRATION DATE: Wednesday, September 18, 1946; 7:00–9:30 P.M.

DURATION OF COURSE: 18 weeks.

TUITION FEE: $22.50. Veterans free under G. I. Bill of Rights.

SCHEDULE: Class meets once a week every Wednesday, 7:00–9:30 P.M., beginning with registration date, September 18, 1946.

INSTRUCTOR: Mitchell Raskin, Superintendent, Polishing and Plating Department, Ruby Lighting Corp., Member of Los Angeles Branch.

●

New Enthone Brass Cleaner

Enthone, Inc., 442 Elm Street, New Haven, Conn., has developed a new alkali cleaner called *Enthone Brass Cleaner.*

This cleaner is stated to have high detergent ability and, in addition, has no tarnishing action on active metals including copper, brass, bronze, nickel, silver, tin and lead. It can, therefore, be used as a general plating room cleaner for cleaning of steel and the metals listed. It has high detergent qualities for soak or electrolytic cleaning. It can also be used for scrub cleaning because it does not contain strong alkalis.

A feature of the cleaner is the long life during operation due to stable surface active materials and buffered alkali balance.

A bulletin is available describing the features of this product by writing to Enthone at the above address.

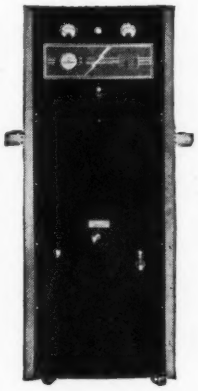
●

Westinghouse Introduces New All-Steel Motor

Major improvements in design and construction of the widely used induction motor, pioneered 58 years ago by Nicola Tesla should not logically be expected. Usually after such a time any device reaches a stage in its evolution where changes relate only to detail.

However, this year a new alternating-current motor makes its appearance which, it is claimed, represents a sudden advance above the normal rate of progress. This motor, known as the *Life-Line*, is more than 35 per cent smaller in size than its predecessor. The reduced size has been accom-

ELECTROPLATING becomes scientific with the R-A SELENIUM RECTIFIERS!



9 volts—2000 amperes
9 volts—1500 amperes
9 volts—1000 amperes
9 volts— 500 amperes
18/9 volts—500/1000 amperes
6 volts—2000 amperes
6 volts—1500 amperes
6 volts—1000 amperes
6 volts— 500 amperes
12/6 volts—500/1000 amperes

Make your selection of these completely self-contained Selenium Rectifiers with meters, off-on switch and stepless variable control. Standard units can be used in multiple arrangements to obtain 5000 and 10,000 amperes or higher.

WRITE TODAY FOR THE R-A WAY

Rectifier Divison
RICHARDSON-ALLEN CORPORATION
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plished without sacrifice of electrical properties. Starting torques have been increased as much as 134 per cent per pound of motor and maximum torques increased as much as 116 per cent per pound of motor. High efficiencies and power factors are maintained. The appearance is certainly much improved and, perhaps even more important these days, maintenance requirements are materially decreased. Specifically, the bearings will need no attention for at least five years. Shock resistance is increased manyfold. Vibration and noise have been reduced to new low limits. Fewer insulation burn-outs will be experienced because of new features in insulating materials and improved winding techniques. In short, this newest squirrel-cage motor takes its place with four or five other peaks of progress in motor history.

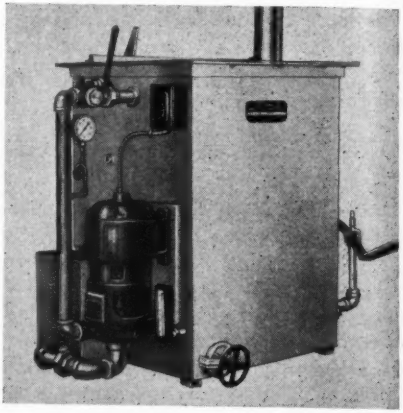
●

Spray Type Washer Announced by Optimus Equipment Company

A new, spray-type washing machine, for the quick and thorough washing of parts on racks, has been announced by the *Optimus Equipment Company*, 131 Church Street, Matawan, N. J., manufacturers of washing and drying equipment.

This new Optimus machine can be placed directly on the floor—no pit or cement work is necessary. The top of the unit is at working height, and all connections are readily accessible. Lever operated valve makes starting of the spray easy. Spray nozzles are adjustable and replaceable.

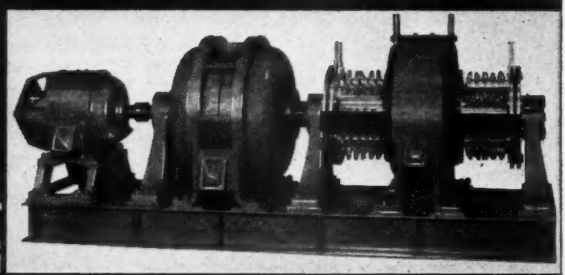
The same machine can be used with sub-



merged agitation to remove caked greases such as Tripoli Compound and abrasives.

This machine is designed to eliminate slow and laborious hand-cleaning of small metal parts. It can be used individually, or in

COLUMBIA MOTOR GENERATORS



FOR ELECTRO-PLATING

Columbia Generators embody every feature essential for dependable, 24-hour operation. They are built for electroplating service in sizes of 6 to 20 volts, 500 to 20,000 amperes, for anodic treatment of aluminum in sizes of 40, 50, and 60 volts, 500 to 3,000 amperes. Columbia Generators for other electrolytic processes range from ½ to 250 KW, 100 to 40,000 amperes, 6 to 60 volts. Write for full information.

COLUMBIA ELECTRIC MFG. CO.

4519 HAMILTON AVE., N.E. CLEVELAND 14, OHIO

series where the washing operation requires several steps, for example solvent wash, rinse, alkali wash, second rinse, all of which operations can be performed with this Optimus spray-type washing machine.

●

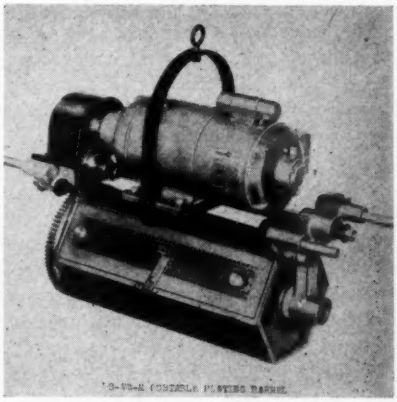
New Portable Plating Barrel

The *Hanson-Van Winkle-Munning Company*, Matawan, N. J., has announced a recent plating barrel development, the *Mercil Portable Barrel Unit*, designed for small quantities of work and easily movable to any location as needed.

This unit can be furnished with steel cylinder for cleaning, with a Monel cylinder for pickling, or with a rubber or Bakelite cylinder for plating. The cylinder for cleaning or pickling (made of steel or Monel) is 8″ in diameter x 18″ long. The apparatus is furnished with a special Janette motor-reducer to drive the cylinder at 1.6 r.p.m. The motor is totally enclosed and mounted on the tie rod assembly directly above the cylinder.

The Unit with the steel cylinder can also be used for tanks containing solution for black oxide finishes such as Jetal.

The unit for plating (with rubber or Bakelite cylinder) has chain dangler contacts and the cylinder can be 6″ in diameter x 12″ long or 8″ in diameter x 18″ long. The Janette motor and reducer are arranged so that a cylinder speed of 5 to 6 r.p.m. can be secured.



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HARRISON 4-A COMPOUNDS

QUALITY and UNIFORMITY

We will gladly send samples of any compounds we manufacture for

CUTTING—CUT AND COLOR—MIRROR FINISH

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Double Header Compounds—Sizes 150–180–220–240–320
for Faster Cutting—Greater Economy

Ready for Use—CEMENT AND THINNER—Use Abrasive Cold

HARRISON & COMPANY, Inc.

HAVERHILL MASSACHUSETTS

A cable is attached to the live end of the hanger so that the user can easily attach it to negative bus bar on the still tank.

The overall length of the portable unit with the 6″ x 12″ cylinder is approximately 20″; height, approximately 16″; weight, in the neighborhood of 70 lbs. A cylinder of this size will hold approximately 2 quarts of work.

This equipment is supplied with pins in the hanger arms, as in the regular Mercil type cylinders. The user can arrange to provide saddles on the tank into which the cylinder with the pins can be placed.

●

Frank P. Smith Appointed du Pont Sales Engineer

Appointment of *Frank P. Smith* as a Sales Engineer in the Cleveland Region has been announced by *E. I. du Pont de Nemours and Company.* He reports to *W. E. Kreuer,* Regional Industrial Sales Manager in Cleveland. After November 1st, Mr. Smith's office will be located at 601 E. Robinson Street, Pittsburgh. He will serve the clientele formerly served by *W. J. Bradley* for the du Pont Finishes Division

Since his return a year ago from duty with the U. S. Navy, Mr. Smith had worked in the Philadelphia area. During the war he was Supervisor of the Paint Laboratory of the U. S. Naval Air Experimental Station there.

Born in Philadelphia, November 11, 1910, and graduated from Girard College in 1927, Mr. Smith came to the du Pont Company as a clerk in the analysis department of the Philadelphia office a year later. He spent four years in the Philadelphia Finishes Laboratory, and six years as a special industrial sales correspondent in the Finishes Division.

●

Mitchell-Bradford Chemical To Handle Iridite Sales

The *Mitchell-Bradford Chemical Company,* 2446 Main Street, Stratford P. O., Bridgeport, Conn., has been appointed exclusive distributor for the sale of *Iridite* in the New England area by *Rheem Research Products, Inc.,* manufacturers of the *Iridite* process.

The area granted to the Mitchell-Brad-

FOR SALE Available for Immediate Shipment

2—15,000/7500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC CO.** Motor Generator Sets. Separately Excited. Full Control Equipment. Write for full details.
3—5000/2500 AMPERE, 6/12 VOLT, **COLUMBIA ELECTRIC CO.** Motor Generator Sets. Separately Excited. Excellent Condition. Full Control Equipment.
1—5000/2500 AMPERE, 6/12 VOLT, **EAGER ELECTRIC COMPANY** Motor Generator Set. Separately Excited. Excellent Condition. Full Control Equipment.
1—4000/2000 AMPERE, 3/6 VOLT, **HANSON & VAN WINKLE CO.** Motor Generator Set. Separately Excited. Excellent Condition. Full Control Equipment.
1—3000/1500 AMPERE, 6/12 VOLT, **BENNETT & O'CONNELL CO.** Motor Generator Set. Separately Excited. Excellent Condition. Full Control Equipment.
1—2500/1250 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.** Motor Generator Set. Separately Excited. Full Control Equipment. Excellent Condition.
1—2000/1000 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Motor Generator Set. Practically New. Latest design. Synchronous motor drive. Full Control Equipment.
1—1500/750 AMPERE, 6/12 VOLT, **IMPROVED AMERICAN GIANT** Motor Generator Set. INTERPOLE CONSTRUCTION. D.C. Motor. Excellent Condition. Full Control Equipment.
1—1500/750 AMPERE, 6/12 VOLT, **HANSON & VAN WINKLE CO.** Motor Generator Set. Excellent Condition. Full Control Equipment.
1—1000/500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.** Motor Generator Set. Full Control Equipment. Excellent Condition.
4—1000/500 AMPERE, 6/12 VOLT, **CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Sets. Separately Excited. Full Control Equipment.
1—1000 AMPERE, 50 VOLT, **CHANDEYSSON ELECTRIC CO.** SYNCHRONOUS-DRIVEN Anodizing Motor Generator Set, complete with Exciter and Full Controlling Equipment.
2—500 AMPERE, 40 VOLT, **MOTOR GENERATOR CORPORATION** Anodizing Motor Generator Sets. Excellent Condition. Full Controlling Equipment.
1—500 AMPERE, 24 VOLT, **HANSON & VAN WINKLE CO.** (INTERPOLE TYPE) Motor Generator Set. Excellent Condition. Full Controlling Equipment.
1—**HANSON-VAN WINKLE-MUNNING CO.** SEMI-AUTOMATIC PLATING UNIT—For Cyanide Plating—Practically New—Size: 24 ft. x 4 ft. x 3 ft.

M. E. BAKER COMPANY 143 SIDNEY STREET CAMBRIDGE, MASS.

ford Chemical Company includes the states of New York, Connecticut, Rhode Island, Massachusetts, Maine, New Hampshire, and Vermont.

●

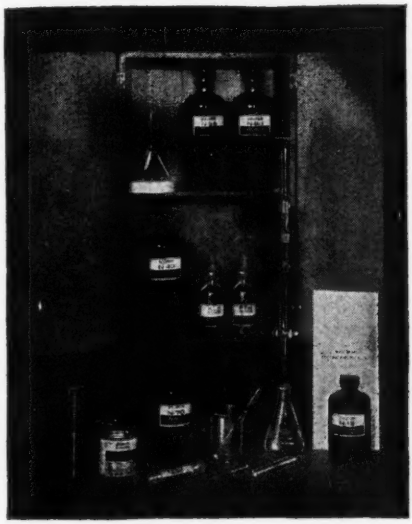
Abijah U. Fox, Mathieson Board Chairman

Election of *Abijah U. Fox* as Chairman of the Board of Directors of *The Mathieson Alkali Works* has been announced by *George W. Dolan*, President. Mr. Fox recently returned from Europe where he served as Deputy Director, Finance Division, U. S. Military Government, Germany.

Prior to his War Department post, Mr. Fox was with the Treasury Department, which he joined in 1941. He served as Deputy Director, Foreign Funds Control, and Director of the Office of Surplus Property.

From 1926 until 1941, Mr. Fox was in financial work in the Far East. After graduating from Rutgers University in 1926, he went to Tokyo for the National City Bank and remained there for eight years as Assistant Manager. In 1934, he joined the security investments firm of Swann, Culbertson & Fritz, an affiliate of Hayden Stone & Company. As managing partner, Mr. Fox was at the main office in Shanghai until he returned to this country in 1941.

Born in Brooklyn, N. Y., Mr. Fox now resides in Greenwich, Conn.



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Simple test sets for aid in controlling plating and other solutions.

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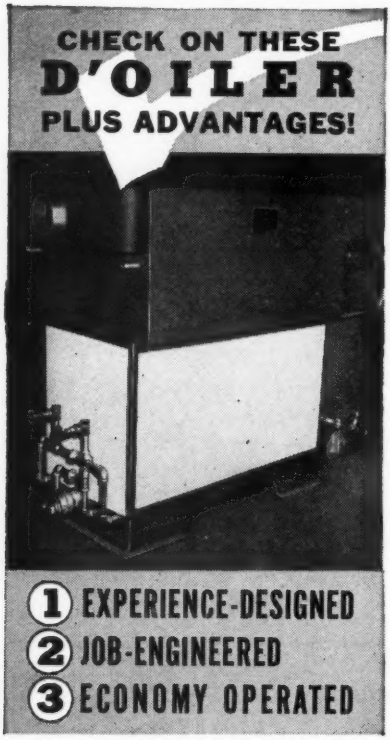

FOR THOROUGH METAL CLEANING

The D'OILER Vapor Spray machine, illustrated above, can be used as a vapor-spray, or a straight vapor degreasing unit. Drain table recaptures dragout from basketed parts . . . all-around insulation reduces heat losses . . . exhaust duct on two sides safeguards operator . . . pump drive for standby solvent eliminates hand pouring.

Every D'OILER type is built to do a specific job . . . is designed with the "on-the-job experience" necessary to provide a degreaser that does the work, in the required volume, economically.

Our engineers will gladly advise on degreasing problems; your inquiries will receive prompt attention. Write today.

Mechanical
PROCESS COMPANY
P. O. BOX 88, SOUTH ORANGE, N. J.

Optimus To Manufacture and Market Vapor Degreasers

Optimus Equipment Company, 131 Church Street, Matawan, N. J., engineers and manufacturers of metal washing and drying equipment, has announced the manufacture and marketing of a complete line of metal parts degreasers in standard and special models.

The new equipment will include degreasers for a wide range of applications. Machines will be available embodying a varied number of cleaning cycles, including: vapor, vapor-spray, liquid-liquid-vapor, and liquid vapor, as well as combinations of these and the use of supplementary pump and spray washing facilities to meet special requirements.

The latest improvements in metal degreasing equipment design and manufacture will be featured. Engineering will be in the hands of Optimus engineers who have long experience in the manufacture of such equipment. The first machines have come off the production line.

Optimus Detergents Company, manufacturers of industrial cleaning materials, also of Matawan, N. J., and an affiliated company, will have available the vapor degreasing solvents required by users of Optimus Equipment, as well as by others in the metal finishing field. The solvents *Triclene D* and *Perclene*, manufactured by *E. I. du Pont de Nemours and Company*, will be supplied from several conveniently located warehouses.

●

du Pont Appoints J. P. Martel Design Division Manager

The *du Pont Company* has announced the appointment of *J. P. Martel* as Manager of the Design Division, Engineering Department, to succeed *Melvin F. Wood*, recently appointed Assistant Chief Engineer of the Company.

At the same time, the Company announced the appointment of *F. W. Pardee, Jr.*, as Assistant Manager of the Design Division, and appointment of *R. P. Genereaux* as Assistant to Mr. Pardee on special assignment.

Bureau of Standards Issues Underground Corrosion Data

Investigation of underground corrosion was begun by the National Bureau of Standards in 1922. From time to time reports of the results of this study have been published in the Bureau's *Journal of Research.* The work at the Bureau has been under the direction of *Kirk H. Logan,* Chief of the Underground Corrosion Section, and most of the reports have borne his name as the sole author or one of the authors.

These reports have been most useful to those interested in this subject, but by being scattered through issues of the *Journal* over a long period of years, it has not always been easy to have a complete set for ready reference. This has been particularly true when younger engineers have entered the field and have needed this material because some of the older issues were not available as individual reprints.

The essential data from all these reports have now been reassembled into a single bound volume which will be a definite and necessary addition to the library of any engineer interested in this subject. The volume is entitled *Underground Corrosion* (National Bureau of Standards Circular C450), and is for sale by the Superintendent of Documents, Washington 25, D. C., at a price of $1.25.

•

New Industrial Adhesive Introduced by du Pont

A new industrial adhesive that requires no catalyst or special preparation for use has been announced by *G. E. Conde,* Director of Research, Parlin, N. J., Finishes Laboratory, *E. I. du Pont de Nemours and Company.*

Mr. Conde said that with No. 4665 cement it is felt a demand for a "fool-proof" liquid adhesive will be filled. He pointed to a six months' minimum package stability with no tendency to gel inside of a year as an outstanding property of the new cement.

No. 4665 was described as being tough and flexible, suitable for bonding metal foils and metal sheets to wood, plastics, vulcanized synthetic and natural rubbers, as well

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ACID PROOF CONSTRUCTION

THE CEILCOTE CO.
Consulting and Research Engineers
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CLEVELAND, OHIO

as other substances having widely different coefficients of thermal expansion.

The dried adhesive film is resistant to dilute alkalis, acids, and corrosive salt solutions. According to Mr. Conde the Parlin, N. J., laboratory, where the new adhesive was developed, reports that it is not attacked by petroleum or coal-tar solvents, lubricating oils, alcohols, ethylene glycol, or vegetable oils, but is soluble in ketones or ester solvents. Moreover, the cement is resistant to mildew and fungi.

A booklet (A-6031) containing more detailed information on No. 4665 cement, as well as data on bonding techniques, is available on request to Room 8018, the Finishes Division, E. I. du Pont de Nemours & Company, Wilmington 98, Del.

●

New Plating Apparatus Announced by H.-V. W.-M.

The *Hanson-Van Winkle-Munning Company*, Matawan, N. J., has announced the development of the new *Mercil Plating Apparatus* with pumping equipment.

Tests have shown that where the plating apparatus is furnished with pumping equipment, the plating time is reduced. For example, on one such unit where cadmium plating is being done, the plating time has been cut from 20 to 25%. In working with cyanide solutions, the amount of cyanide consumed is cut down and the carbonates in the bottom of the tank are reduced in volume. The solution is agitated by the pump and a finer grade of plated work is obtained.

Where cyanide solutions are involved an iron pump is furnished, whereas in acid solutions, such as nickel, a Duriron pump is specified. The pump capacity is from 25 to 100 gallons per minute, depending upon the size of the installation.

When the pumping unit is in operation the solution is drawn off from the tank through a perforated pipe near the bottom and is pumped back into the tank through a pipe running the full length of the unit, situated directly under the overflow, which allows the solution to be pumped directly into the inside of the cylinder.

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We are equipped to fabricate tanks of Steel, Lead or Rubber Lined, Monel Metal, Stainless Steel, Copper, Aluminum, Inconel, etc.

Tanks are supplied with or without exhaust ducts and fans as conditions or specifications indicate.

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Nickel Plating Solution

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ADDITION AGENTS

Send a sample of your present bath to see if it is suitable for conversion to this improved formula.

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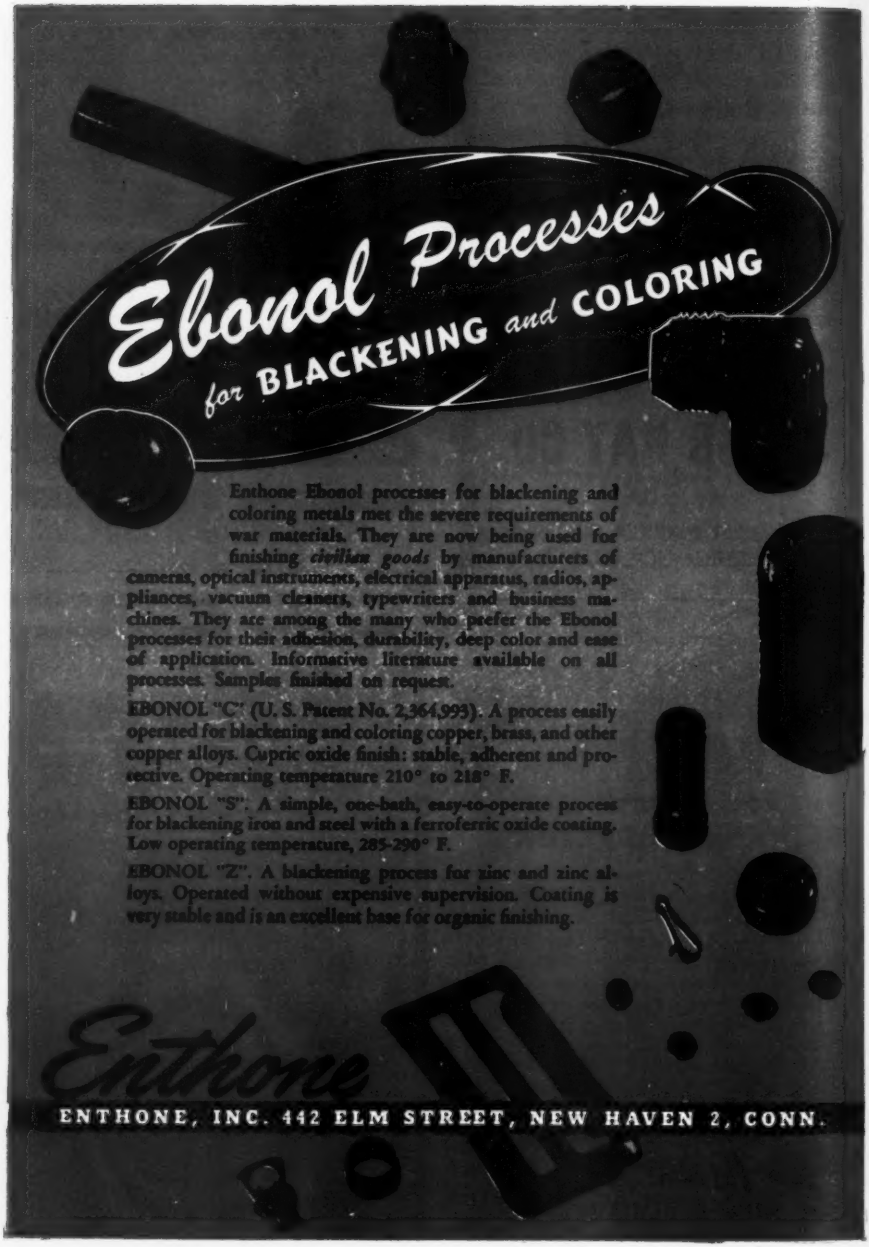
Ebonol Processes
for BLACKENING and COLORING
Enthone Ebonol processes for blackening and coloring metals met the severe requirements of war materials. They are now being used for finishing *civilian goods* by manufacturers of cameras, optical instruments, electrical apparatus, radios, appliances, vacuum cleaners, typewriters and business machines. They are among the many who prefer the Ebonol processes for their adhesion, durability, deep color and ease of application. Informative literature available on all processes. Samples finished on request.
EBONOL "C" (U. S. Patent No. 2,364,993). A process easily operated for blackening and coloring copper, brass, and other copper alloys. Cupric oxide finish: stable, adherent and protective. Operating temperature 210° to 218° F.
EBONOL "S". A simple, one-bath, easy-to-operate process for blackening iron and steel with a ferroferric oxide coating. Low operating temperature, 285-290° F.
EBONOL "Z". A blackening process for zinc and zinc alloys. Operated without expensive supervision. Coating is very stable and is an excellent base for organic finishing.
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ADELAIDE, AUSTRALIA. Acting Secretary G. N. Dixon, G. P. O. Box 428D, Adelaide, Australia.

BALTIMORE-WASHINGTON meets first Tuesday of each month, in October, December, February and April at the Engineers' Club, Baltimore, Md, and in November, January, March and May at Kenesaw Apts, Washington, D. C. Secretary-Treasurer, L. G. Tubbs, 7011 Kenleigh Road., Baltimore 12, Md.

BOSTON meets first Thursday each month at Hotel Statler, Boston, Mass. Secretary, Dr. George P. Swift, 53 Galen St., Watertown 72, Mass.

BRIDGEPORT meets first and third Friday of each month at Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn.

BUFFALO meets second Friday of each month at Hotel Statler, Buffalo, N. Y. Secretary, J. A. Kushner, 316 Winslow Avenue, Buffalo 11, N. Y.

CHICAGO meets second Friday of each month at 8 P. M., at Atlantic Hotel. Secretary, M. H. Longfield, 1528 S. 61st Avenue, Cicero 50, Ill.

CINCINNATI meets on second Wednesday of each month at 8 P. M., at the Engineering Society Headquarters, McMillan Street and Woodburn Avenue, Cincinnati, Ohio. Secretary-Treasurer, Charles Nuzum, Schaible Co., Summer St., Cincinnati 4, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel, at 8 P. M. Secretary-Treasurer, George B. Svenson, 2059 Hamilton Ave., Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at the Battelle Memorial Institute Auditorium, 505 King Avenue, Columbus 1, Ohio, at 8 P. M. Secretary, John G. Beach, Battelle Memorial Institute, Columbus 1, Ohio.

DAYTON meets second Friday of each month at the Engineers Club, Dayton, Ohio. Secretary-Treasurer, Ralph L. Clinefelter, 365 W. Hayes St., West Milton, Ohio.

DETROIT meets the first Friday of each month at the Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich.

GRAND RAPIDS meets second Friday of each month, 7:30 P. M., at the Rowe Hotel. Secretary, R. Perkins, 916 Fairmount Street, S. E., Grand Rapids 6, Mich.

HARTFORD meets third Monday of each month at Hotel Bond, Hartford, Conn. Secretary, F. W. Smith, 46 Cottage Street, Meriden, Conn.

BRANCH DIRECTORY

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INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary-Treasurer, Carl Niehaus, 937 N. Capitol Ave., Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month at the Home Dairy Co. in Lansing. Secretary-Treasurer, U. J. Forsyth, 1816 Ada St., Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M., at Thaddeus Stevens Industrial School, Lancaster, Pa. Secretary-Treasurer, H. Clay Brubaker, 881 Manor Street, Lancaster, Pa.

LOS ANGELES meets second Monday of each month, at 6:30 P. M., at Hotel Cabrillo, 11th and Broadway. Secretary-Treasurer, E. R. Holman, P. O. Box 2649, Terminal Annex, Los Angeles 54, Calif.

MELBOURNE, AUSTRALIA. Secretary, L. A. Francis, G. P. O. Box 4502.

MILWAUKEE meets first Friday of each month at the Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, James Durnford, 2370 N. 32nd Street, Milwaukee 10, Wis.

MONTREAL meets second Monday of each month at Mount Royal Hotel, Montreal, Quebec, Canada. Secretary-Treasurer, William L. Glover, 754 Second Avenue, Verdun 19, Quebec, Canada.

NEWARK meets first and third Friday of each month at Hotel Robert Treat, Newark, N. J., at 8 P. M. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn.

NEW YORK meets second and fourth Fridays of each month, in the Hotel Pennsylvania, 7th Avenue and 33rd Street, New York, N. Y. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I., N. Y.

PHILADELPHIA meets fourth Friday of each month, in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, Paul Mentzer, Sr., 7242 Bingham Street, Philadelphia 11, Pa.

PITTSBURGH meets third Thursday of each month at 6:30 P. M., at the Keystone Hotel, Pittsburgh, Pa. Secretary-Treasurer, R. A. Dimon, 210 Semple Street, Pittsburgh 13, Pa.

PROVIDENCE-ATTLEBORO meets the third Monday of each month at the Providence-Baltimore Hotel. Secretary-Treasurer, Charles C. Chace, 11 Friendly Road, Cranston 10, R. I.

ROCKFORD meets second Monday of each month at the Faust Hotel, Rockford. Secretary, E. J. Budden, 122 Twelfth Street, Rockford, Ill.

ROCHESTER meets third Friday of each month at the Hotel Seneca, Rochester, N. Y. Secretary, Robert L. Flint, 78 Durand Drive, Point Pleasant, N. Y.

SAN FRANCISCO meets the second Thursday of each month, alternating between St. Julien Cafe in San Francisco and Victor's and Roxies' Cafe in Oakland. Secretary-Treasurer, F. W. Huntington, 1621 Lafayette St., Alameda, Calif.

SPRINGFIELD meets the fourth Monday of each month at the Hotel Charles. Secretary-Treasurer, Paul Lyman, Millers Falls Company, Greenfield, Mass.

ST JOSEPH VALLEY. Secretary, Raymond A. Friend, 1435 Howard Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month at the York Hotel, 6th and

BRANCH DIRECTORY

(Continued from preceding page)

Market Sts. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo.

SOUTHEASTERN meets second Thursday of each month at the Robert Fulton Hotel, 114 Lucky St., N. W., Atlanta, Georgia. Secretary, William T. Weymouth, 173 Clay St. S. E., Atlanta, Georgia.

SYDNEY, AUSTRALIA. Secretary-Treasurer, John Godfrey, P. O. Box 31, Auburn, N. S. W., Australia.

SYRACUSE meets second Friday of each month at Bowne Hall, Syracuse University, Syracuse, N. Y. Secretary, Neil Maffei, 206 Union Avenue, Syracuse 3, N. Y.

TOLEDO meets first Thursday of each month at the office of Vic Miner Company, 329 20th Street, Toledo, Ohio. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month at Royal York Hotel. Secretary, Leonard W. Wray, 105 Ronan Avenue, Toronto 12, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, at the Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 318 Builders Exchange, Minneapolis 2, Minn.

WATERBURY meets second Friday of the month at Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box Dr. B, Cheshire, Conn.

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